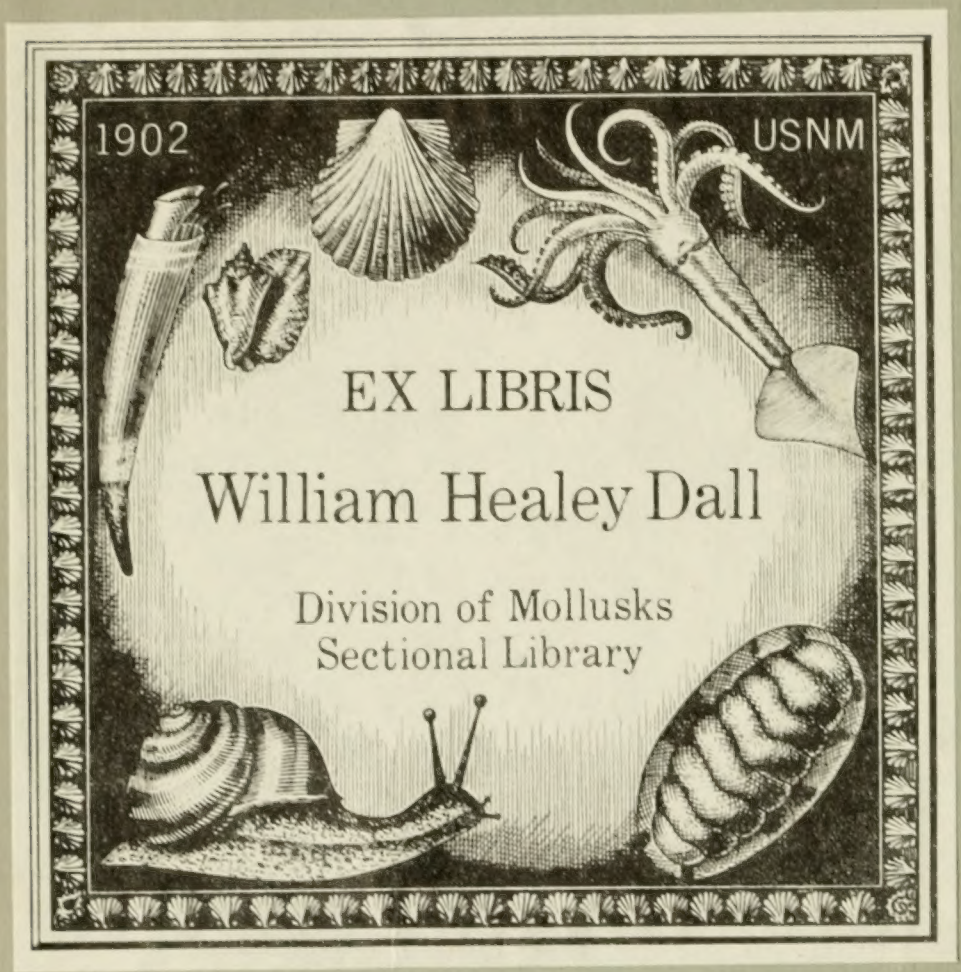
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MONOGRAPH OF THE LAND AND FRESHWATER MOLLUSCA OF THE BRITISH ISLES.

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Yours faithfully
Jno. W. Taylor

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MONOGRAPH

OF THE

LAND & FRESHWATER MOLLUSCA

OF THE

BRITISH ISLES.

BY

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LATE EDITOR OF THE "JOURNAL OF CONCHOLOGY"; ETC.;

WITH THE ASSISTANCE OF
W. DENISON ROEBUCK, F.L.S., THE LATE CHARLES ASHFORD,
AND OTHER WELL-KNOWN CONCHOLOGISTS.

TESTACELLIDÆ.

LIMACIDÆ.

ARIONIDÆ.

LEEDS:
TAYLOR BROTHERS, PUBLISHERS.

1907.

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PREFACE.

THE completion of the present volume, the first and only one ever published devoted exclusively to the Slugs of the British Isles, is a matter of considerable satisfaction, and I trust that the information presented herewith on their variation, habits, structure, geographical and geological distribution will aid in the advancement and further popularization of a study in which of late years so great an amount of interest has been displayed; and consequently it seems a fitting and appropriate occasion on which to include in the Introduction a brief review of the history and progress of Limacology in this country, detailing the rise of the present interest in the group, and the individuals and causes leading to this gratifying result.

The study of Limacology has, however, never been a general one, for although many of the species are undeniably of great beauty, with bright and vivid colouring, frequently variegated, or banded with darker markings of pleasing arrangement, yet the handling of these otherwise beautiful animals, and the difficulty of their satisfactory preservation in collections, have always been very serious drawbacks to the popularization of their study.

The mere bulk of the present volume is far from adequately representing the amount of labour and anxiety which has been expended on its production, especially as, excepting some special artistic assistance from my daughter with certain of the more difficult coloured figures, I have had, as before, to depend solely on my own hand for the preparation of the text, and the index thereto, as well as for the one hundred and twenty nature coloured paintings illustrating the chief variations of the different species, in addition to which I have also prepared upwards of three hundred anatomical and other drawings from which the explanatory figures in the text have been engraved.

Although six years have been occupied in the publication of the volume, this lengthy period has been very fully employed in securing and painting from life many of the illustrations, and in the appropriate arrangement and co-ordination of the mass of information accumulated during the past quarter of a century.

Though it might appear almost invidious to allude to the help rendered by particular individuals, when so many have contributed by their observations and aid to enhance the value and importance of the Monograph, yet I trust I may without injustice again recall with grateful acknowledgment the ever-willing and priceless help so unselfishly rendered me by my late dear friend Mr. Charles Ashford, of Christchurch, whose matchless anatomical skill and scientific acumen were so pre-eminent, while the accuracy and beauty of his preparations and sketches is evidenced by the anatomical diagrams in the present work, many of which are from his hand, and it is to me a matter of sincere regret that my valued friend did not live to see the results of his long and disinterested labours placed permanently on record.

To Mr. W. Denison Roebuck, F.L.S., of Leeds, who initiated the modern study of slugs in the British Isles, I have also been placed under deep obligations for placing his extensive knowledge on the subject so freely at my disposal, as well as for his willing aid in any direction in which the work most severely pressed, and it is with gratitude I acknowledge his great and varied help.

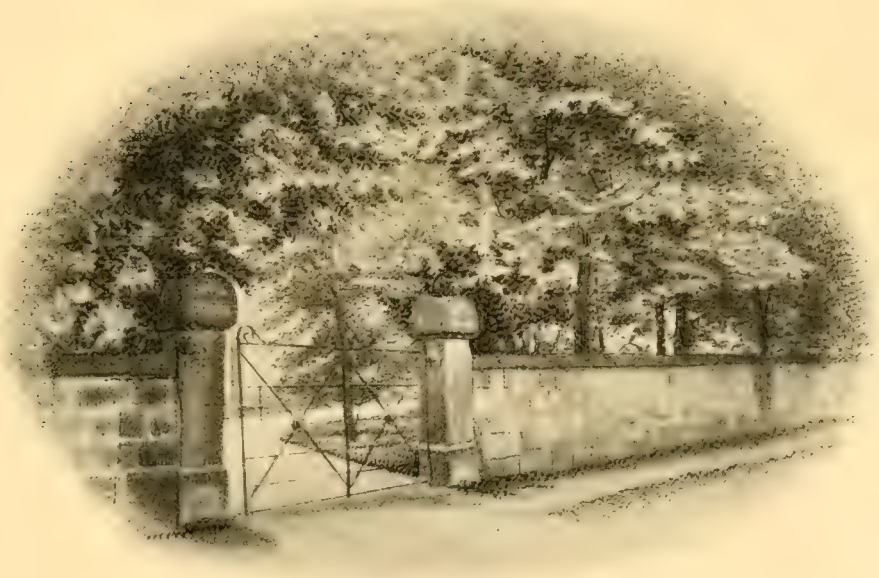
Mr. R. Welch, M.R.I.A., of Belfast, has also on very many occasions rendered me numerous special and valuable services, not only by furnish-

ing many exquisite photographs of the characteristic habitats of various species, but by his active help in working out the molluscan fauna of Ireland, and interesting others in the same good work.

To the many other helpers and good wishers who have so consistently assisted me at every opportunity, and whose help is in every case acknowledged in its appropriate place in the text, I desire to express my sincere thanks and heartfelt appreciation of their kindness, and can only hope that the resultant volume now completed will to some degree realize the hopes and expectations formed regarding it.

JOHN W. TAYLOR.

North Grange, Horsforth,
Leeds, *Dec. 31, 1906.*



INTRODUCTION.

THE naked mollusks, familiarly termed "slugs," judged by their general external aspect, are apparently a closely-related group of animals, but when their organization is closely studied, they are found to be not so nearly allied as they outwardly appear, as the tendency to nudity is one that has affected many diverse families, being a stage of evolution to which almost every group has furnished examples and to which many are undoubtedly tending.

Though it was considered convenient to devote a volume exclusively to the naked species, this was not merely because they could be—from one point of view—suitably placed together, as having arrived at a similar phase of the shell degeneration, many testaceous forms are probably now undergoing, but partly because the phylogenetic relationship of some of the groups is still obscure, and we shall probably require to look for such progenitors, if they be not really extinct, in some of the less advanced regions of the globe.

PHYLOGENETICALLY, *Testacella* and *Daudebardia* have probably been derived from an identical stock, but do not stand in linear sequence. The *Daudebardiæ* have retained their terrestrial habits, while *Testacella* has become more especially adapted to a subterranean existence, probably thereby entering upon a course of deterioration and degradation of type. Their remote testaceous progenitors have probably been long ago expelled from the European region, and must be sought for in the more distant and weaker regions of the earth.

The *Testacellæ* are restricted to Western and Southern Europe and North-western Africa, being bounded towards the east by the range of the nearly-allied *Daudebardiæ*. The group originated in the European region, but some authors have erroneously surmised that the family was evolved within the weak but mysterious recesses of Central Asia, afterwards migrating therefrom by way of southern Europe to this country.

The *Glandinæ* were formerly widely spread over the European region, and also lived in this country, and though still meagrely represented in Southern Europe, are now practically expelled to Central America and the West Indies, where the metropolis of the genus is now located, and where living species have been found scarcely distinguishable from the fossilized shells of our Oligocene strata.

It has been suggested that *Limax* and *Milax* have their immediate derivation from *Hyalinia*, but it is by no means certain that this is the case with *Milax*, Prof. Babor remarking on their strong affinity with *Helix*. The more distant ancestors cannot be indicated with any approach to precision, but it is certain that they would possess a more substantial shell than the *Hyalinia* now possess. The true *Limacidæ* retain the soft and supple body, and the degenerate shell, though reduced to a flat and almost un-nucleated calcareous plate buried beneath the mantle, is still present. The group is almost restricted to the Palæarctic zone, the most advanced and recently evolved species occupying a compact and comparatively restricted area, while the more ancient and primitive species have achieved a wider dispersal, but have been more or less completely expelled from the most active evolutionary region, or compelled to resort to and become isolated in undesirable spots.

The *Arionidæ* are believed to have descended from Endodontoid ancestors, a group which, though world-wide in distribution, has now withdrawn its headquarters or metropolis to the islands of the Pacific Ocean.

The typical genus *Arion* is naturally restricted to the Palearctic region, extending from Portugal to Siberia. It displays the practical completion of the process of shell degeneration, and will in all probability be followed by a gradual calcification of the outer integument, as a dense deposition of lime particles and spicula within its substance has been already initiated, and in *Arion ater* has imparted a certain stiffness and rigidity to the body and to its movements; this being the first stage in the slow evolution of another complete shelly protection. That this, or a similar process, has probably occurred in the past, is demonstrated by the vestiges still present in certain species of mollusks of previously existent primary or primary and secondary shells or "Protoconchs," which are the last remaining evidences of more perfect shells once possessed and successively lost, but which had undergone, untold ages ago, cycles of development and degeneration similar to that many shells are undergoing at the present day.

The genus *Geomalacus* is apparently now confined to Western Europe, and to the south-west corner of Ireland, which is a last foothold for many plants and other forms of life on the verge of extinction in this country.

This genus has been incorrectly assumed to have been evolved in Central Asia and to have migrated therefrom, reaching Ireland by way of the Mediterranean region; while the ancient Arionid, described as *Tetraspis* by Dr. Hagenmüller, is according to present knowledge, confined to the grotto of Planina, in Carniola; it presents the earlier stage in the slug evolution, before the mantle had finally closed and fused above the vestigial shell, as it still retains a central opening in the mantle, recalling the space left uncovered by the expanded mantle lobes in *Amphipeplea glutinosa*. Dr. Simroth, is, however, disposed to regard *Tetraspis* as founded upon abnormal *Arion intermedius* or young *A. subfuscus*; but, even if this conjecture be correct, the atavism is equally remarkable and instructive.

Geographical Distribution is closely interwoven with the problems of evolution, and when studied compels the acceptance of the existence of zoological regions, these being immense areas or districts more or less isolated from each other by natural obstacles to dispersal, and each possessing a fauna which to a great extent is peculiar to it; yet the forms of life they now harbour will inevitably, in process of time, be slowly and gradually changed to species of a higher type, drawn directly from a neighbouring more advanced area, but primarily emanating from the European region, where it is fairly well established as a general law that the more ancient the geological formation containing the fossil remains of any group of organisms, the further removed geographically is their present abode and in proportion as they are found in more and more recent deposits, the nearer to the European area are their living representatives to be found at the present day.

This is corroborated by Dr. Wallace and others who have affirmed that the Eocene period is represented faunally in the Africa of to-day, and the Miocene in that of Madagascar, while the faunal and floral features of New Zealand, Australia, and other distant southern countries represent the European at still earlier epochs.

Similarly the isolated districts now occupied by species of a more generalized type than those occupying the surrounding areas, must not be regarded as the cradle of those species, as some have so confidently declared, but must rather be regarded as a sanctuary to which the more generalized and consequently weaker forms have retreated to escape the severe competition of the improved stronger forms evolved from their descendants.

Nor is it more accurate to regard the present metropolis or headquarters of a species or group as necessarily disclosing the theatre of its origin. If the species or genus be an ancient one, it is very improbable indeed that such is the case, and much more likely that it is merely one of

the stages of their retreat away from the evolutionary centre, in avoidance of the competition from the improved races that have succeeded them.

A study of the various groups attests the accuracy of this important generalization and law, and demonstrates that the distribution and dispersal of animal life generally is not that illogical process, as some aver, in which the weak and strong forms of life equally multiply, increase in numbers and promiscuously invade each other's territories; but, as it cannot be too strongly emphasized, the distribution over the globe of all life is based upon the domination, greater increase, and consequent spreading of the stronger and most recently evolved forms, and the enforced retirement before them of the weaker and less adaptable species, which in their turn press upon and successfully compete with the still more primitive species that preceded them.

This is abundantly manifest when the phenomena are impartially studied and it becomes clear that the representatives of weaker races are not advancing and never do permanently advance towards the European region, but in every case are retreating further and further from the original evolutionary region before the more powerful species originating there, and which as a consequence of their predominance and adaptability increase rapidly in numbers, and must therefore perforce extend their boundaries.

Still further confirmation is given by our experience of European species when transferred to a new country amidst a palpably weaker fauna or flora, as in New Zealand; under such circumstances the intruders prosper amazingly to the detriment and eventual extirpation of the indigenous species; whilst on the contrary any attempts to permanently naturalize the organisms of a weak country within the European region are foredoomed to failure.

The highest evolution is shown by the marvellous adaptability and predominance of the European forms, and is internally evidenced by a greater concentration of the œsophageal ganglia within the cephalic region, while a potential ability to resist hard conditions may be conferred by the elaborate intestinal coiling, which gives a greater digestive and absorptive power, and therefore will enable the maximum nourishment to be derived from the most meagre amount of food.

This predominance of the European forms of life is not confined to mollusks, as Prof. Alfred Newton, our most philosophical ornithologist, has averred that amongst the birds also, the weaker types have been very generally eliminated in the western palæarctic region, and that all the species are of the most dominant character, with the greatest powers of dispersal, and these features are as strongly shown by the mammals and other groups.

The restriction of the dispersal of dominant species in certain directions may be satisfactorily explained by the presence of physical obstacles or by the competition to which they become subjected from other species of like habit and of an almost equal development.

Variation, whether in form, colouring, or habits, tends to be protective, and leads to general adaptability or to special adaptation, the former tending to advancement, and the latter towards degeneration, and such being the biological expression of the changes of the environment, are always worthy of attentive study, and the neglect that is usually accorded to so-called casual variations is quite unmerited, as these, if not atavic, probably indicate the direction in which the variation of the particular species or group is tending, or the aberrant individuals may, owing to the less pronounced character of the surroundings, be the outliers of the district or region where the particular form is the prevalent one; the latter case is well seen in the var. *albolateralis* of *Arion ater* which, though occasionally found in other parts of this country in diminished brilliancy and beauty, is in certain portions of North Wales very distinctive and quite the commonest form of the species. In like manner the var. *maculata* of *Limax arborum* is quite rare and sporadic in England, but in Ireland is much more plentiful, but the causes of these aberrations have not yet been discovered.

The change resultant from a different environment may be in the direction of warning colours or markings, as displayed by the vividly coloured forms of the var. *rufa* of *Arion ater*, which, by the deposition of the coloured excretory products within and upon the outer integument, have rendered themselves distasteful to former enemies, the vivid colouring acting as a warning indication of their probably nauseous character as food.

On moist ground and upon the cloudy and mist-enveloped hills and mountains, a darker pigmentation of the body usually takes place, assimilating the animals more closely to the dark, damp aspect of the stones and rocks among which they dwell. This effect is shown especially and strikingly by *Limax arborum*, and is also confirmed by *Geomalacus maculosus* and *Arion ater* var. *aterrima*, although the latter has also been reported as inhabiting low and swampy ground.

In *Agriolimax agrestis* a tendency is shown during the autumn months for the animals to approximate in colour to the dead and fallen leaves so universally prevalent at that season of the year, the body of the animal becoming flecked over with brown, or even changing to a general brownish tint.

Limax tenellus by its yellow or pallid colouring, without noticeable lateral banding, assimilates very closely to the aspect of the fungi upon which it lives, and is not readily perceptible in such situations.

External or tegumentary variation is quickly responsive to the changes of environment, and the various colour mutations undergone in process of growth by various of the naked species are colourings which were not improbably beneficial and protective in former times, and it is very significant as tending to shed a light upon their true evolutionary centre that certain atavic varieties of many species characterized by the retention of juvenile colours or markings are more prevalent at the confines of their distribution than near the probable point of origin of the species.

Structural modification is a much slower and more deliberate process, and though undoubtedly proceeding everywhere, is much more rapidly accomplished in the European region, which is, and has been for ages past, the centre of the greatest evolutionary activity and the focus from which improved forms of life have emanated and spread over the whole surface of the globe, only interrupted by the rigours of the more extreme climatic changes to which the world has been from time to time exposed during the progress of geological time, or by the varying dispositions of land and water, which, however, would in many cases tend to accelerate and facilitate dispersal.

The History and progress of Limacology in these islands may be studied by enumerating in chronological sequence the species so far established as British, and it seems on the whole better, as a simple act of justice to the acumen and perspicuity of the original investigators, to base the account upon the order in which the various species were definitely introduced for the first time into the British fauna, rather than to give the honour to the modern limacologists, who afterwards confirmed the truth of their predecessors' discernment by the demonstration of structural and other differences.

The existence of certain species in this country was, however, in several instances foreshadowed by some of the older and more careful writers long before their instatement in our lists.

The history of Limacology in the British Isles may for the present purpose be resolved into a modern and an earlier period of activity, separable by a certain interval of neglect.

The earlier period of activity is identified with the great names of Lister, Alder, Gray, Johnston, and Clarke, although the slugs were not specialized, except by the last-named author, being merely studied in the course of the general investigation of our terrestrial mollusca.

The first author to describe British slugs was Dr. Martin Lister, one of the celebrated trio who founded the modern scientific study of natural history in England, and it is to this able investigator that we owe—amongst numerous other things—the first faunal work on British mollusca and their earliest anatomical investigation.

In 1678 he published under the title of "Animalium Angliæ Tres Tractatus . . . . Alter de Cochleis tum Terrestribus tum Fluviatilibus" an account of the British land and freshwater mollusca which from a scientific point of view will bear comparison with many works published even in modern times, and it is to the great glory of Lister that he paid careful attention to all aspects of his subject, studying it from every point of view. He was a capable anatomist, and published subsequent works dealing with the internal structure of our mollusks.

In this work of 1678 the first three slugs known as British :

1. **Limax maximus,**
2. **Agriolimax agrestis,**
3. **Arion ater,**

were for the first time described and figured, although the existence of the first-named species was indicated twelve years before in Merret's "Pinax Rerum Naturalium Britannicarum."

In 1681 Lister published a supplement to his work, of which supplement a second edition appeared in 1685, but in this only the red variety of the last-named species is brought forward.

The next addition to our list was also by Dr. Lister in 1685 and 1694, when, in his "Conchology" and "Exercitationes Anatomicæ," he figured and described the anatomy of our fourth species :

4. **Limax flavus.**

The fact that the figure does not bear the letter A, by which Lister was in the habit of distinguishing the English species in his general works, may be safely disregarded.

The next faunal work in which the slugs were included was not published for nearly one hundred and fifty years after Lister's, but in the meantime the effect of the Cuvierian impetus to the study of the natural sciences at the beginning of the nineteenth century was seen in the description as new or the introduction into our lists of four species.

In 1819 Férussac published his splendid work : Histoire Naturelle générale et particulière des Mollusques Terrestres et Fluviatiles, in which he described and cited a British habitat for

5. **Testacella maugei,**

our first recorded shell-slug.

In the "Medical Repository" for 1821, Dr. J. E. Gray described a second species of *Arion* as an inhabitant of this country :

6. **Arion hortensis.**

In 1823 Sowerby published his "Genera of Recent and Fossil Shells," in which he described a second species of *Testacella* :

7. **Testacella scutulum.**

This, however, after the issue of Turton's Manual of 1831 was regarded as but a slight variety of *T. haliotidea*, and consequently disappeared from our lists as a species.

In the same year, 1823, Férussac described from British examples the first of our two species of keeled slugs :

8. **Milax sowerbii.**

Meanwhile, various faunal works on mollusca had been issued by Da Costa, Donovan, Montagu, Maton and Rackett, and others, in which the slugs were not included, but in 1828 the Rev. John Fleming published his "History of British Animals," in which we find the first description as British of the third species of *Testacella* :

9. **Testacella haliotidea.**

In the same year, Dr. George Johnston, in a paper criticizing Fleming's work, described a third species of *Arion* :

10. **Arion circumscriptus.**

This species, however, never afterwards appeared in our lists and manuals, other than as a synonym or variety of *A. hortensis*, or as the supposed young of *A. ater*, even by Johnston himself, and was only finally re-established as of true specific rank fifty-eight years afterwards.

Turton's Manual, published in 1831, was the first to bring all these species together in one work, except the *Arions*, which, having no distinct shell, found no definite place in a work devoted to testaceous mollusca.

In 1832 and 1833 Mr. John Denson published detailed and elaborate accounts of *Milax sowerbii* and *Testacella scutulum* in the "Magazine of Natural History," and in 1837 Mr. Thomas Nunneley published in the Leeds Transactions a detailed account with figures of the anatomical structure of the first four British species, describing therein the intestinal appendix of *Limax flavus*, and his careful and accurate work, the first molluscan anatomy after Lister's, foreshadowed the closer attention paid in late years to this branch of the subject.

In 1838 Dr. George Johnston brought forward in his Berwickshire list another species :

11. **Agriolimax lævis,**

and in the same list includes "*Arion subflavus*" without description, in addition to *Arion ater*, thus ignoring not only *Arion hortensis* but his own *Arion circumscriptus*.

In 1840 Dr. Gray published his so-called new edition of Turton's Manual, in reality a new work, and in this he sank *Arion circumscriptus* and *Testacella scutulum* as being but slight varieties, and also excluded *T. maugei* as non-indigenous.

But in the same year, 1840, a new enthusiast and very capable investigator appeared, who may be regarded as our first British limacological specialist. The Rev. B. J. Clarke took up the detailed study of the Irish slugs, and in the "Annals and Magazine of Natural History" for 1840 and 1843 he established the existence of two new British species of which there had not previously been any indication in our literature :

12. **Limax arborum.**
13. **Milax gagates.**

His papers also include indications of *Arion subfuscus* and *Limax cinereoniger*, as well as show that the author was aware of the presence in Ireland of *Arion circumscriptus* and *Testacella maugei*, although he did not venture to reinstate them as species.

In the same year, 1843, *Limax arborum* is first mentioned as Scottish in Macgillivray's "History of the Molluscous Animals of Aberdeen, Kincardine, and Banff."

In 1842 an important discovery was made by Mr. W. Andrews in the form of the remarkable new slug, which in 1848 Dr. G. J. Allman described with a full anatomical account as

14. **Geomalacus maculosus.**

In 1848 Mr. Joshua Alder's "Catalogue of the Mollusca of Northumberland and Durham" was published in the Tyneside Field Club Transactions. It is a work of great importance to us, as in it were brought forward two species new to Britain :

15. **Arion intermedius,**
16. **Limax tenellus,**

and there is also a distinct reference to the slug we now know as *Arion subfuscus*.

These additions mark the close of the earlier periods of the active scientific investigations of our British slugs, for although malacologists generally were by no means inactive, and numerous manuals were published including those of Brown in 1845, Leach in 1852, Forbes and Hanley in 1853, Gray's Turton in 1857, Jeffreys in 1862 and 1869, Reeve in 1863,

and Tate in 1866, no further additions were made to our slugs or any notable contribution to their study for a period of nearly thirty-five years.

The present or modern period of activity in the study of our slugs began in 1882, when Mr. W. Denison Roebuck took up the subject as a special line of research, and by the active co-operation of British conchologists received many thousands of slugs from all parts of the British Isles for examination, forming an excellent groundwork for the true appreciation of their distribution, variation, and developmental history.

The late Mr. Charles Ashford, the most skilful molluscan anatomist that we have ever had in this country, soon became associated with Mr. Roebuck in the good work, and made hundreds of dissections of the various species and varieties, confirming the external specific characters of the various species by demonstrating the differences in their internal structure.

The impetus thus given to the study was the means of bringing other investigators into the field, and greatly popularizing the subject.

In Mr. Roebuck's paper on the British slug list, published simultaneously with the Conchological Society's list of British land and freshwater mollusca, 1883, the specific status of

17. **Limax cinereo-niger**

was affirmed, and the name added to the British list.

The close and systematic examination of the anatomical and morphological character of the Arions soon showed that another species of Arion:

18. **Arion subfuscus,**

existed in this country, and although the first published notice of it as British was by Herr D. F. Heynemann in 1885, yet the associated labours of Mr. Ashford and Mr. Roebuck upon undoubted British specimens independently established its claim to inclusion in the British list.

Continued investigation of the Arionidæ resulted in the identification in 1886 of Mabille's *Arion bourguignati*, mainly by the aid of anatomical evidence. The first mention of it as British was by Mr. John Emmet, writing on behalf of Mr. Roebuck in the "Naturalist" for June 1886, and later study disclosed that the supposed new discovery was but an authoritative reinstatement of Dr. Johnston's *Arion circumscriptus*.

Another resurrection made by Mr. George Roberts in 1887 and Dr. R. F. Scharff in 1890 was *Arion intermedius*. The real credit of the reinstatement, however, was due to Dr. Scharff, who showed from anatomical evidence that *A. minimus* existed with us, although in 1887 Mr. Roberts had given a clear description of its external morphology under the name of *Arion flavus*. Subsequent synonymic study demonstrated that these names referred to one and the same species, for which *A. intermedius* was the original name.

In 1888 occurred the specific reinstatement of *Testacella scutulum*, chiefly by the aid of Mr. C. Ashford's exquisite dissections. Strictly speaking, however, it would be more correct to speak of it as the definite installation of both forms—*T. haliotidea* and *T. scutulum*—as distinct species and members of our fauna.

With one notable exception, this closed the list of the definite replacements of valid species, although during the next few years various forms were from time to time described as new to this country or to science, which eventually proved to be pure synonyms or simple varieties of already-known species.

An excellent piece of work by Dr. Scharff was his superb Monograph, "The Slugs of Ireland," which evinced sound work and careful investigation, while numerous papers and books by Mr. W. E. Collinge, Mr. J. W. Williams, Mr. W. A. Gain, Mr. Lionel E. Adams, Prof. T. D. A. Cockerell, and others, testified to the keen interest aroused in the study by the stimulus first given in 1882.

The last important re-discovery—*Limax tenellus*—was made in 1904, when the Rev. R. Godfrey, who had previously collected the species in Switzerland, sent numerous examples, collected in Rothiemurchus Forest, to Mr. Roebuck, who was at once able to verify the species as the long-lost *Limax tenellus*, probably hitherto overlooked by the nature of its habitat, and it was a great satisfaction to be able once more to vindicate the sound scientific ability of its original finder, the late Mr. Joshua Alder.

In conclusion, though the probability of further discoveries of truly distinct species is not great, yet it is not impossible that closer research and careful anatomical investigation may ultimately reveal other forms as yet unsuspected or it may be confused with the more abundant and widely-distributed species.

EXPLANATION

OF THE

TERMS, SIGNS, AND METHODS OF RECORD

USED IN THE PRESENT WORK.

! The exclamation mark is used in accordance with an accepted custom, as a mark or token of verification, and indicates that the specimens from the locality or district mentioned have been seen and verified by the author.

Records in which a date is given immediately AFTER the name of the locality signifies that the specimens were collected at that time.

Records in which the date does NOT PRECEDE but follows the name of the collector signifies only the date when the specimens were examined, and that no precise record has been kept of the date when the specimens were collected.

The names of authors when placed within parentheses and following the names of species implies that the generic name used is not the same as that used by the original describer; when the parentheses are not used the species retains its original allocation.

All Records and observations under each species are almost invariably used only in association with the particular name used by the author whose information is being made use of. This mode of treatment is desirable, as though giving all information in its appropriate position, it yet preserves the connection with the name to which it belongs, so that if the reference to the particular species be objected to, the information can be extracted, as it is not confused with other records.

A

MONOGRAPH

OF THE

LAND AND FRESHWATER MOLLUSCA

OF THE

BRITISH ISLES.

Phylum MOLLUSCA Cuvier.

(Malacozoa, Blainville; Palliata, Latreille; Heterogangliata, Owen; Otocardes, Haeckel; Saccata, Hyatt; Tetraneura, Schimkewitsch).

The Mollusca (*mollis*, soft) are animals with soft and fleshy bodies, covered by ciliated epithelium, containing numerous interspersed cells which abundantly secrete the mucus which is so characteristic a feature of the group and gives the body its suppleness and viscosity.

They possess a cephalic region in which are located most of the organs of special sense, a pallial region which develops or secretes the shell, and a pedal or ventral region which constitutes the locomotory organ.

Internally they present distinct digestive, cœlomic and circulatory cavities and scattered nerve centres, and primitively were bilaterally symmetrical in their organization.

Class GASTROPODA Cuvier.

(Paracephalophora, Blainville; Cephalophora, Macalister; Glossophora, pars, Lankester; Cephala, Reeve; Univalvia, Fischer).

The Gastropods (γαστήρ, stomach; ποδ– foot) are the most typical of the molluscan phylum, possessing the distinctive characteristics of the group in the greatest degree and showing the least affinity to other phyla.

Their chief features are a ventral and sole-like reptatory foot; a distinct head; a well-developed odontophore, armed with numerous transverse rows of recurved teeth; a hollow and more or less conical shell which may be spirally coiled and external, or reduced to the merest vestige and concealed within the tissues.

Sub-Class *ANISOPLEURA* Lankester.

(Gastropoda, Pelseneer; Platycochlides, Ihering).

The Anisopleura (α, not; ἴσος, equal; πλεῦρά, sides) are characterized by the asymmetry of their organization, due to the torsion and semi-rotation the visceral sac has undergone, which has transferred the respiratory and excretory organs from their original posterior position to an anterior and lateral one, and also led to the diminution or even complete atrophy and loss of the primitively left auricle, the left kidney, and the left moiety of other of the paired organs of the body.

Order EUTHYNEURA Lankester.

(Platymalakia, von Ihering; Pulmonata, Fischer; Monœcia, Troschel; Adelapneumona, Gray; Pulmonifera Inoperculata, Woodward; Inoperculata, Reeve; Saccobranchia, Leach).

The Euthyneura (εὐθύς, straight; νεῦρον, a nerve or tendon) embrace those land, freshwater, and marine gastropods in which the twisting of the visceral nerve-ring, characterizing the Streptoneura, has become obliterated by the partial detorsion the visceral sac has since undergone, and is also noticeable

Smithsonian Institution, JUL 31 1902 192703 National Museum

for the shortening of the connectives and commissures and tendency of the ganglionic centres to concentrate around the pharynx, the œsophagus passing between the cerebral and buccal ganglia, and the anterior aorta separating the pedal and visceral centres.

The Euthyneures are hermaphrodite and inoperculate pulmoniferous species, usually possessing a highly vascular, respiratory pallial chamber, without ctenidia, but exceptionally developing secondary branchiæ in a few genera that are reacquiring aqueous respiration.

Sub-Order *STYLOMMATOPHORA* A. Schmidt.

(Pulmonifera, Reeve; Helicea, Von Martens; Geophila, Binney).

The Stylommatophora (στῦλος, a pillar; ὄμματα, eyes; φέρω, to bear), embrace those Euthyneures with distinct head and two pairs of hollow retractile tentacles, the posterior and longer pair are the ommatophores, and bear the eyes near their summit, where is also located the chief seat of the olfactory sense; the smaller anterior pair are also olfactory, but more especially tactile, in function. The otocysts[1] are imbedded upon the pedal ganglia and contain numerous otoconia;[2] the nerve centres are closely aggregated and fused together in a nerve ring around the pharynx, and the sexual orifices are closely contiguous or united in a common passage at the side of the neck.

Family TESTACELLIDÆ Gray.

(Oleacinidæ, Binney; Agnatha, Mörch; Vermivora, Gray).

The *Testacellidæ* embrace the genera *Rhytida*, *Paryphanta*, *Streptaxis*, *Daudebardia*, *Glandina*, and *Testacella*, with a few other exotic groups, all characterized by an enormous development of their radula, by the absence of the mandible, and by their predacious habits. Of these genera only *Testacella* inhabits this country, but that *Glandina* also formerly did so is undeniably established by its fossil remains in our tertiary strata.

Genus *TESTACELLA* Cuvier.

(Helicolimax pars, Fér.; Testacellus, Faure-Biguet).

History.—*Testacella* (dim. of *testa*, a shell) was discovered at Dieppe by M. Dugué, and his careful and accurate observations on its habits and appearance, under the appellation of "Limace à coquille," were published in 1740 by Reaumur,[3] who, however, did not apply to it any distinctive scientific name. In 1800, Cuvier,[4] impressed by the peculiarities of the shell, created the genus *Testacella* for its reception, and in 1804 described and figured the internal structure of the animal.

Generic Characters.—Externally, the distinguishing features of *Testacella* may be summarized as: Body limaciform, markedly attenuate anteriorly; integument coriaceous, thickest in the rear; peripodial groove[5] distinct; tentacles simple, without definite apical enlargement; eyes small and black; lips tactile and very extensible; lateral grooves[6] distinct, diverging from the peripallial sinus and terminating near the base of the tentacles, giving off from each side a number of supra- and sub-lateral, anteriorly directed, shallow, branching grooves, whose intersections form the granulation which is so manifest during contraction; sole not tripartite as in *Limax*; mantle small, placed quite in the rear of the animal, and covered by a vestigial and somewhat auriform, paucispiral shell, from which the periostracum is usually more or less abraded; muscular scar crescentic in shape; respiratory and anal orifices beneath right posterior angle of shell. Sexual orifice beneath right ommatophore.

1 Monog. i., p. 237, ff. 2 Monog. i., p. 239, ff. 3 Observ. de Physique générale, pp. 1, 2.
4 Leçons d'Anat. Comp. t. 1, 5e tabl. 5 Monog. i., p. 192, f. 377. 6 Monog i., p. 205, f. 402.

INTERNALLY, the most important peculiarity, as compared with the *Limacidæ*, is the location of the heart[1] near the posterior extremity of the body, accompanied by a corresponding change in the position of the pulmonary cavity and anal aperture, the kidney and the shell, which are usually in relation with it. As in *Limax*, the heart is anterior to the kidney, but occupies its right anterior corner, and the auricle is larger than the ventricle, and directed obliquely backwards, the ventricle in front, in consonance with the altered course of the aortic trunks.

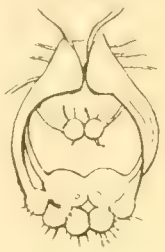


FIG. 1.—Nerve ring of *T. haliotidea*, Bristol. × 5, showing the arrangement of the ganglia.

The VISCERAL SAC is almost completely untwisted, resulting in the pulmonary plexus being moved to the rear of the obliquely-placed heart, *Testacella* being thus opisthopneumonic; KIDNEY without secondary ureter;[2] SUPRA-PEDAL GLAND long and sinuous, lying free on upper surface of the foot and extending almost to the posterior extremity of the body.[3]

The NERVOUS SYSTEM is chiefly centralized in a nerve ring, encircling the enormous lingual sheath, the closely contiguous CEREBRAL GANGLIA above it giving off long and thick connectives to the pedal and visceral ganglia which are fused together beneath: the long cerebro-buccal connectives surround the œsophagus, and the buccal ganglia are fused together or at least in contact, not separated by a longish commissure as is usual in the *Limacidæ*.

The OLFACTORY faculty is well developed and exhibited as a large ganglion with ramose terminations at the apex of each of the posterior tentacles or rhinophores.[4]

Simroth also affirms that he has detected a double fringe of nerves of the same sense within the pallial chamber, a relic of the primitive osphradium. The EYE is small and black and the vision feeble and myopic, the optic nerve, which shows scarcely any dilatation, separating from the nerve of olfaction quite at the base of the tentacles.

FIG. 2.

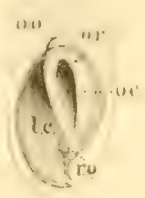


FIG. 3.

FIG. 2. Rhinophore of *T. haliotidea* (after Moquin-Tandon) greatly enlarged, showing the ganglionic enlargement and the ramose terminations of the olfactory nerve. *e* eye with optic ganglion and nerve.

FIG. 3.—Pallial olfactory organ or osphradium of *T. maugei* (after Simroth). *o.o.* olfactory orifice; *o.c.* olfactory cavity; *o.r.* olfactory ridge; *r.o.* respiratory orifice; *l.c.* lung chamber.

The ALIMENTARY CANAL is simple, showing few flexures; the MOUTH very dilatable, its inner surface protected by a thick layer of chitin; the ODONTOPHORE large, beset with transverse, obliquely arcuate rows of slender, barbed and apically-pointed teeth, typical of Beloglossa;[5] ŒSOPHAGUS short; CROP voluminous and muscular, functioning as the digestive sac, and held in position by a sheet of separate slender muscles, arising from the sides of the body, but most conspicuous on the left side; the true STOMACH is reduced to a small receptacle at first bend of gut near the opening of the bile ducts; INTESTINAL TRACT short, with but two tracts or Dichodromous.[6]

FIG. 4.—Alimentary canal of *T. haliotidea* from Horsham, ×1½, showing the simplicity of its course and an unusual development of the vestigial stomach.

1 Monog. i., p. 293, f. 583. 2 Monog. i. p. 336, f. 626. 3 Monog. i., p. 311, f. 604.
4 Monog. i., p. 226, f. 118. 5 Monog. i., p. 267, f. 535. 6 Monog. i., p. 285, f. 568.

The LINGUAL SHEATH white and gristly, exhibiting externally along its left upper surface a distinct longitudinal suture or seam on opposite sides of which, at the hinder end, the paired constituents of the retractors are affixed; the enormous development of the retractors is in strict correlation with the nature of their food, as to overcome the highly muscular and struggling earthworms demands a predominating antagonism; TENTACULAR RETRACTORS very long and quite independent of the pharyngeal group, and of each other, with widely separated points of attachment to the integument, differing thus from the Limaces, and forming with *Arion* the group Trichorhiza.[1]

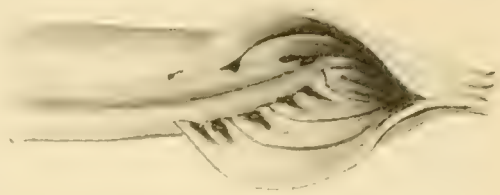


FIG. 5.—Hinder end of lingual sheath of *T. maugei*, from Hayle, Cornwall, × 1, showing the paired insertions of the retractors.

The REPRODUCTIVE ORGANS are comparatively simple, varying somewhat not only in the relative proportions of their various parts, but also as in other groups increasing vastly in size at the approach of the breeding season; the OVOTESTIS small, imbedded within the large digestive gland; the HERMAPHRODITE DUCT closely convoluted and entering the large and yellowish albumen gland about its middle; OVIDUCT with broad, ample folds, suggestive of large eggs, partially doubled upon itself, owing to the high attachment of spermatheca; PENIS SHEATH only moderately developed; no mucus glands; ATRIUM short and narrow; penis and vagina separated by the right tentacular retractor.

Reproduction and Development.—In mild weather, especially in spring and autumn, the pairing takes place, the tentacles being retracted during the process, which occupies four or five hours. Five or six days afterwards, ten or more eggs are deposited within the underground galleries, sometimes a yard or more beneath the surface. The eggs are oval and white, somewhat acuminate at the ends, and although enclosed by a hard, calcareous shell, explode with a perceptible noise when removed from the ground and placed upon the hand or in a warm place, but, according to Faure-Biguet, they may be preserved if plunged at once into boiling water.

The eggs hatch in from ten to thirty-five days, according to the species and the prevailing temperature, the young at once entering upon a predatory life, devouring young earthworms and the minute white threadworms which live beneath decaying vegetation; they usually become adult in about eighteen months, and may attain five or six years of age.

Food and Habits.—They are predacious and very voracious and not only prey upon worms, but will also devour slugs, snails, centipedes, and even small individuals of their own kind, although, according to Gassies, they will not eat dead animals, and even decline fresh worms which have been chopped up to feed them, Bouillet, however, records that chopped worms are devoured by the *Testacella* when laid as bait on the ground. The prey is seized by a rapid protrusion of the odontophore, the worm becoming impaled upon the multitude of barbed and aculeate teeth which divaricate during protrusion; the radula is then retracted and the worm or other prey is gradually engulphed in the maw of its enemy, but so slowly in some cases that one end of a worm may have become digested within the stomach while the other end still alive projects from the mouth. When gorged with food the animal becomes lethargic and contracted, but if disturbed during a meal they will often disgorge the prey they may be consuming.

1 Monog. i., p. 311, f. 638.

TESTACELLA.

1.—*T. haliotidea var. albina, in repose,*
Kingsbridge, Devon.
W. E. Baily.

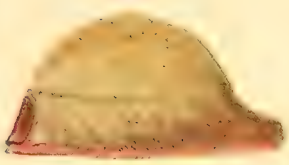
2.—*T. haliotidea,*
Oxford, E. B. Poulton.

3.—*T. haliotidea × 3,*
Horsham, J. Whitaker.

4.-*T. h. var. trigona × 3,*
Glasnevin Gardens,
Dublin, R. F. Scharff.

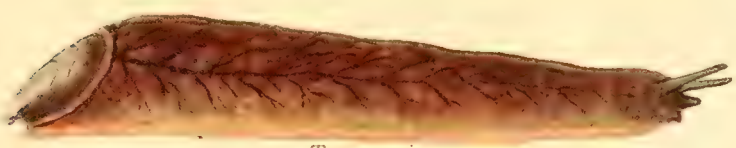
5.—*T. h. var. major × 3,*
Horsham, J. Whitaker.

6.—*T. scutulum × 3,*
Chiswick,
S. C. Cockerell.

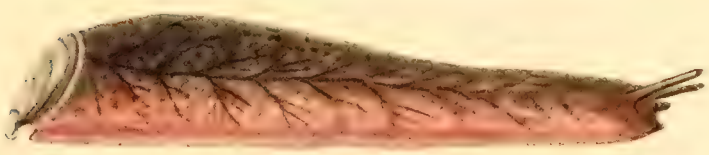


7.—*T. s. var. albina, in repose,*
Hornsey, H. Wallis Kew.

8.—*Testacella scutulum,*
Cuerden Hall, Preston, W. H. Heathcote.

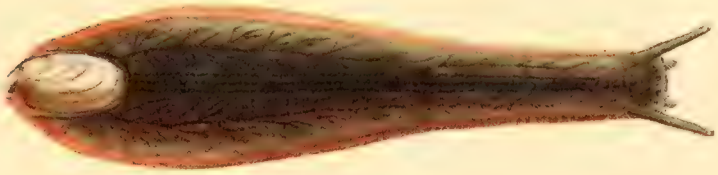


9.—*T. maugei,*
Riccard's Down, Bideford, C. R. C. Hibbert.



10.—*T. maugei var. griseo-rubescens,*
Corfe Castle, E. R. Bankes.

11.—*T. maugei var. aurea,*
Cotham, Bristol, Miss F. M Hele.

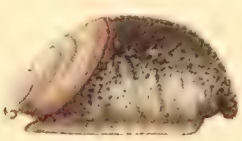


12.—*T. maugei var. viridans,*
Waterford, J. H. Salter.

13.—*T. maugei × 2,*
Bristol, Miss F. M. Hele.

14.—*T. maugei × 2,*
Bristol,
Miss F. M. Hele.

15.—*T. m. var. aperta × 2.*
Azores.



16.—*T. m. var. griseo nigrescens, in repose,*
Pembroke, Mrs. Trayler.

They are nocturnal animals, usually remaining beneath the surface of the soil during the day, preferring the rich, well-manured lands in which their prey is plentiful, and in this country, according to Mr. E. J. Lowe, are found from sea level up to an altitude of 530 feet, and although reaching a greater altitude in France, yet Fischer records that they do not attain an altitude of 3,250 feet in Auvergne. Although usually living only a few inches below the surface, they vary the depth in accordance with the moisture of the ground and the consequent motions of the earthworms, but also come forth at nightfall when the earthworms also emerge from their burrows; the worm when seized by the *Testacella* instantly retracts itself within its tunnel by the aid of its circlets of bristles, dragging with it the *Testacella*, which attenuates itself sufficiently to allow this to be done.

The saturation of the ground due to the rains so prevalent in spring and late autumn is very prejudicial to the *Testacellæ*, driving them from their subterranean retreats to the surface, where they seek to hide during the day beneath stones, rubbish, or in other places frequented by worms.

In cold and dry weather, and when preparing for hibernation, they retire deeply into the earth, contracting their bodies and enveloping their hinder extremity within the extended mantle, ensconcing themselves each within a small and firm earth-chamber, which is cemented together by their colourless and somewhat viscid mucus, and is smooth and glistening inside, but externally bears some resemblance to the cocoon of a "puss" moth.

Enemies.—According to the testimony of Mr. Miller and Miss Marshall, earthworms will destroy young *Testacellæ*, and Mrs. Falloon informs me that a very small wireworm also preys upon them.

Geographical Distribution.—*Testacella* is entirely a western palæarctic group, and the distribution of the constituent species is strikingly in harmony with the relative simplicity or complexity of the internal structure of the animal, the more primitive of the species being confined to the vicinity of the western seaboard, while the more highly organized forms have a more eastern range. The genus is replaced in eastern and south-eastern Europe and the western Asiatic region by *Daudebardia*, a group of predacious snails with close affinities to *Testacella*.

The so-called West Indian *Testacellæ* are more properly referred to *Omalonyx*, a genus of *Succineidæ*, in which the shell has undergone a somewhat parallel course of degeneration.

Geological History.—Fossil species of *Testacella* have been recorded from various localities in the Middle and Upper Miocene, the Pliocene, Pleistocene, and Holocene strata of continental Europe.

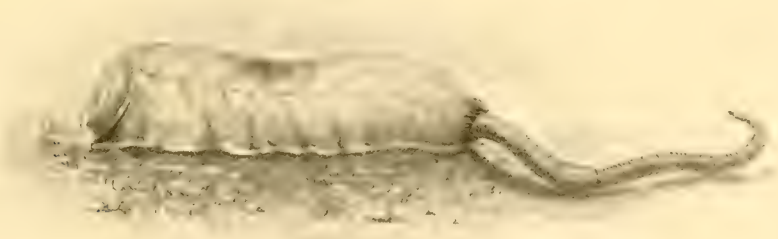
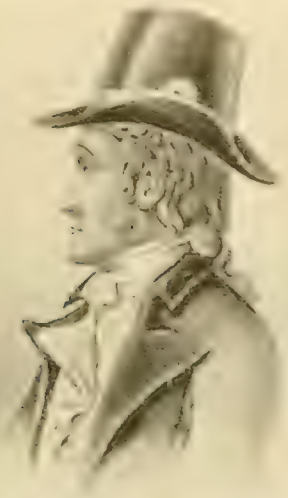


FIG. 6.—*T. maugei* devouring a worm.

Testacella haliotidea Draparnaud.

1801 Testacella haliotidea Drap., Tabl. Moll., pp. 33, 99; Hist. Moll., 1805, p. 121, 122, pl. 8, ff. 43-45, pl. 9, ff. 12, 13; Jeffr., Brit. Conch., 1862, p. 145, pl. 5, f. 6; Reeve, Brit. Moll., 1863, p. 30; Moquin-Tandon, Moll. France, 1855, p. 39, pl. 5, f. 1.
1805 — *europea* Roissy, Buff. de Sonn., v., pl. 53, f. 8, p. 252.
1815 — *gallica* Oken, Lehrb. Nat., iii., p. 212, pl. 9, f. 8.
1888 — *dubia* Pollonera, Boll. Mus. Zool. Anat. Comp. Torino, pl. 2, ff. 4-6.
1888 — *barcinonensis* Poll., Boll. Zool. Anat. Comp, Apl. 14, p. 4, pl. 2, ff. 13-16.
1802 *Testacellus haliotideus* Faure-Biguet, Bull. Soc. Phil., p. 98, pl. 5, f. 2 A-D.
1806 *Helix subterranea* Lafon-du-Cujula, Desc. Lot-et-Garonne, p. 143.



J. P. R. Draparnaud.

HISTORY.—The *Testacella haliotidea* (*Haliotis*, a genus of marine shells, εἶδος form) is recorded as having been first found by M. Dugué at Dieppe in 1740, but it did not receive a specific name until Draparnaud in his "Tableau" bestowed upon it the name of *haliotidea*. In the British Isles it is recorded as first noticed in 1801 by Dr. Lukis in his garden in Guernsey.

T. haliotidea is in many respects the most highly organized of the genus, and is probably the latest evolved species, this being also indicated by its more eastern distribution and the tendency towards a less advanced development of its peculiarities in the more remote localities.

Diagnosis.—EXTERNALLY, the characteristic features of *T. haliotidea* are the somewhat contiguous but distinctly-separated origin of the lateral grooves at the peripallial furrow, and the whitish colour of the animal; the shell differs from that of *maugei* in being smaller, but wider in proportion and in the columella being very broad at the posterior end; from *scutulum* it differs in its more convex and solid shell, and slightly convex columella.

INTERNALLY, it is sharply separated from both its allies by the development of a distinct epiphallus and flagellum to the penis sheath.

Description.—ANIMAL capable of great elongation, sometimes reaching to 120 mill., but ellipsoidal or lenticular when contracted, the narrow cream-coloured FOOT-FRINGE forming a sharp but wavy submedian edge; the BODY is usually of a greyish-white or dull cream colour, but occasionally yellowish or brownish with a greenish tinge, sprinkled with pale brown specks; MID-DORSAL LINES distinct and enclosing a somewhat perceptible double row of elongate tubercles; LATERAL GROOVES well-marked, about two mill. apart at their origin at the peripallial furrow, the subsidiary anteriorly directed supra-lateral furrows ramify and intersect dorsally with about nine faint and shallow longitudinal grooves; below the lateral grooves, the sub-lateral furrows give rise to a more pronounced granulation. SOLE whitish, tinged with yellow, convex and transversely furrowed when contracted. MUCUS clear, with a tinge of pale yellow after scalding.

SHELL convexly auriform, thick and solid, with a dull brown periostracum, which is usually totally abraded from the more exposed parts; NUCLEUS inclined at about 45 deg. to the vertical line; COLUMELLA white and glossy, broad posteriorly and slightly convex, regularly arched but not continued to the anterior end of shell or distinctly truncate; OUTER LIP only slightly shouldered. Length, 8 mill.; breadth, 5½ mill.; alt. 2 mill.

INTERNALLY, the REPRODUCTIVE ORGANS are more complex than in the allied species, the PENIS-SHEATH being terminated distally by a cœcal enlargement and an abrupt flexure, although Lacaze-Duthiers and others figure the male organs, of what they affirm to be this species, without these adjuncts; beyond the penis is the EPIPHALLUS and a well developed and somewhat clavate FLAGELLUM, which Lacaze-Duthiers affirms is evaginated during pairing; and which is furnished with a slender lateral and a powerful distal retractor, the latter affixed at the caudal extremity of the body; the VAGINA and ATRIUM are usually rather short; the large oval SPERMATHECA is attached to the oviduct near the base of the albumen gland, and has a short, thick and fusiform duct; OVOTESTIS composed of small, loose, oblong follicles with a tortuous duct.

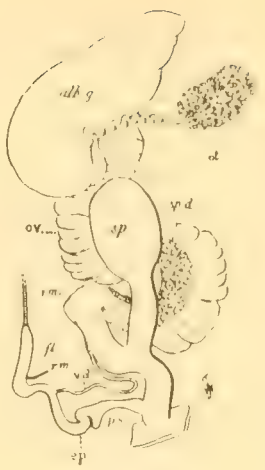


FIG. 8.—Sexual organs of *Testacella haliotidea* ×1½. (Horsham, Mr. T. Whitaker). *alb.g.* albumen gland; *ep.* epiphallus; *fl.* flagellum; *ot.* ovotestis; *ov.* oviduct; *p.s.* penis sheath; *r.m.* retractor muscle; *sp.* spermatheca; *sp.d.* sperm duct; *v.d.* vas deferens.

The ALIMENTARY CANAL has the simple doubly-flexed course characteristic of the genus *Testacella*. The ŒSOPHAGUS is extremely short, the CROP whitish, longitudinally and transversely wrinkled, and about 8 mill. long, beyond which the canal is constricted; at the first bend of the gut, the vestigial STOMACH shows as a purplish enlargement, and receives the bile ducts from the ample light-brown liver; a short distance beyond the canal gradually narrows and runs backward as the rectum to the anus.

The RETRACTORS of the right and left tentacles are separate, quite independent of each other, and almost symmetrically fixed near their respective foot-margins.

The LINGUAL SHEATH is very long, somewhat compressed, tapering obliquely behind, and reaching back nearly to the hinder extremity of the body, RETRACTORS consisting of three or four partially fused terminal muscles, secured to the skin of the left side beneath the shell, and in addition ten to fifteen pairs of oblique ribbon-like lateral muscles, arising from the left side of the hinder half of the sheath, the most anterior being about six mill. long and attached to the skin on the left side of the mid-dorsal line, while the shorter and more posteriorly-placed muscles are fixed nearer and nearer to the sole, to which the last few muscle-bands are fixed, close by the straight terminal ones.

FIG. 9.—Lingual sheath of *Testacella haliotidea*, Bristol, collected by Mr. J. W. Cundall, illustrating the retractor muscles of the tentacles and lingual sheath.

The LINGUAL TEETH are stout, arcuate, and distinctly barbed, with the convex apical surface furnished with a somewhat distinct cutting blade, the median

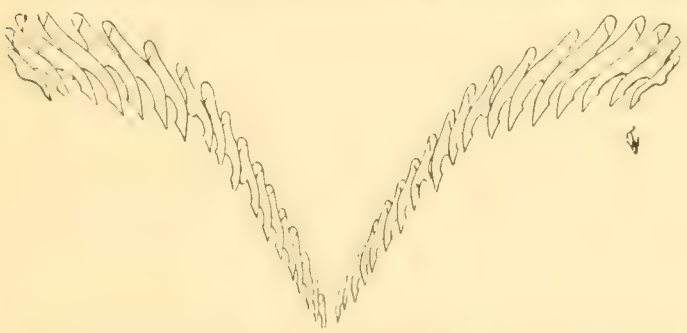


FIG. 10.—Transverse row of teeth from the odontophore of *Testacella haliotidea* × 20, from Oxford, collected by Professor Poulton, photographed by Mr. T. W. Thornton.

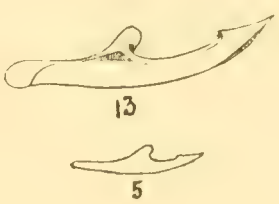


FIG. 11.—Isolated teeth from the fifth and thirteenth longitudinal rows of the radula of *T. haliotidea* × 40.

apophysis large and distinct, basal enlargement slight, and the transverse rows more acutely angulated[1] than in the allied species. According to Lacaze-Duthiers, the vestigial median teeth are discernible with a magnifying power of 200-300 diameters.

The dental formula[2] of an Oxford example is

$$\frac{18+0+0+0+18}{1\ \ 0\ \ 0\ \ 0\ \ 1} \times 38 = 1368$$

1 The figure of the dentition given in Woodward's Manual, p. 293, and copied therefrom as that of *Testacella haliotidea* by many authors, is not really that species, but should be assigned to *T. maugei*.

2 Monog. i., p. 262.

Reproduction and Development.—The eggs are few in number, about six mill. by four mill., with opaque, yellowish-white calcareous shells, they are oblong-oval in shape, but, according to the Abbe Dupuy, eventually becoming somewhat terminate at the poles.

Fig. 12. Fig. 13.

Fig. 12.—Eggs of *T. haliotidea*, immediately after deposition, × 1½ (after Dupuy).

Fig. 13. Egg some days after deposition, × 1½ (after Dupuy), showing the change of form.

They are deposited deep in the earth galleries during the spring months, and, according to Gassies, hatch in ten or twelve days, the young being usually of a greyish colour dashed with greenish-yellow, and becoming adult in the autumn.

Food and Habits.—*T. haliotidea* is markedly nocturnal in habit, emerging from the earth on the approach of twilight, and seizing upon the worms as they extend themselves from their burrows; they re-enter the earth at daybreak, or hide beneath stones or other objects, their marked resemblance when contracted to a pebble assisting their concealment.

According to Gassies & Fischer, this species is less gregarious and more solitary in its habits than *T. maugei*, but is found most easily and frequently at daybreak in March and April, crawling over the surface of the soil or hiding beneath dead leaves or rubbish.

Geological History.—*T. haliotidea* has not been found fossil in this country, but is found in the quaternary deposits at Villefranche, department Aveyron, and in those of Toulouse, in the Haute Garonne; it has also been detected in the blue argillaceous marls near Montpellier, and in the sandy bed of the ancient lake of Sarlièvе near Clermont, Puy-de-Dôme.

Variation.—Gassies & Fischer discriminated five varieties of this species, and Moquin-Tandon six others, but these cannot all be accepted, as these authors confused *T. scutulum* and other species with *T. haliotidea*, regarding them as simple varieties only.

A var. *algerica* is enumerated by Grateloup in Dist. Geog. Limac., p. 16, from Canary Islands, and Oran and Bône in Algeria.

VARIATIONS IN FORM OF SHELL.

Var. **trigona** G. & F., Monog. Testacelle, 1856, p. 46, pl. 2, f. 6a.

var. *dilatata* Pollonera, Boll. Mus. Zool. Torino, Mar. 31, 1889.

SHELL thicker, right margin much dilated, the APEX being thus to the left.

Probably the *T. subtrigona* Pollonera, from Turin, *T. bronderi* Bourg., from the banks of the Edough, near Bône, Algeria, and *T. drymonia* Bourg., from the Isle of Capri, should also be relegated to this interesting and well-marked variety.

Fig. 14. *T. bronderi* Bgt., × 2 (after Bourguignat).

Fig. 15.—*T. drymonia* Bgt., × 2 (after Bourguignat).

Fig. 16. *T. subtrigona* Poll., × 1½ (after Pollonera).

British Isles—Royal Botanic Gardens, Glasnevin, Dublin, 1895! R. F. Scharff.
France—Bordeaux (G. & F., op. cit., p. 50).
Italy—Villa Doyen, Cavoretto, near Torino (Pollonera, op. cit.).
Cuba—Havana, doubtless introduced, Petit (G. & F., op. cit., p. 50).

Var. **elongata** G. & F., Monog. Testacelle, 1856, p. 49, pl. 2, f. 6b.

SHELL long, thin, and narrow.

France—Bordeaux, Comme et Jaudouin (G. & F., op. cit., p. 50).

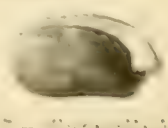


Fig. 17.—*Testacella haliotidea* v. *elongata* × 3 (after Gassies & Fischer).

Var. **ovalis** Moq.-Tand., Hist. Moll. France, 1855, p. 39, pl. 5, f. 19.

SHELL sub-elliptical or oval.

France—(Moq.-Tand., op. cit., p. 39).

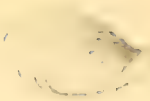


FIG. 18. *Testacella haliotidea* v. *ovalis* (after Moquin-Tandon), enlarged.

VARIATION IN SIZE OF SHELL.

Var. **major** G. & F., Monog. Testacelle, 1856, p. 50.

SHELL very large and thick; COLUMELLA wider, prominent and carinate. Length, 11½ mill. × 7 mill.; alt., 2½ mill.

British Isles—Alman's Nurseries, Horsham, Sussex, June 1886! J. Whitaker.

France—(G. & F., op. cit.).

VARIATIONS IN COLOUR OF ANIMAL.

Var. **albina** Moq.-Tand., Hist. Moll. France, 1855, p. 39.

ANIMAL whitish.

British Isles—Garden, Torcross Hotel, Kingsbridge, Devon, June 10, 1886! W. E. Baily.

France—Toulouse, Haute Garonne, Sarrat (G. & F., op. cit., p. 50); not rare at Puy-de-Dôme, Auvergne (Bouillet, Moll. Auvergne, 1836, p. 19). Ganges, and St. Beauzille, Hérault (Dubrueil, Moll. Hérault, 1863). Bramepan, Basses Pyrénées, (Folin & Berillon, Faune S.O. France, 1877). Perigord, Dordogne (Lacaze-Duthiers, Hist. Test., 1887).

Spain—Gibraltar, Dec. 1884! J. W. Horsley.

Var. **flavescens** Moq.-Tand., Hist. Moll. France, 1855, p. 39.

ANIMAL canary-yellow.

France Toulouse, Haute Garonne, Partiot (Moq.-Tand., Hist. Moll. France, 1855, p. 41). Ganges, and St. Beauzille, Hérault (Dubrueil, Moll. Hérault, 1863). Puy de Dôme, Auvergne (Bouillet, Moll. Auvergne, 1836, p. 19). Les Moulineaux, in abandoned quarries; gardens, Grand Montrouge, and Bourg-la-Reine; environs of Orsay, St. Maur-les-Fosses, etc. (Pascal, Moll. Haute-Loire et Paris, 1873, p. 23).

Geographical Distribution.—This species is known to range over western and south-western Europe and North Africa, and also to extend into Germany, Switzerland, and Belgium, which *T. scutulum* or *T. maugei* are not known to do; this peculiarity in its distribution probably indicates its later evolution, a circumstance apparently confirmed by its more advanced internal organization.

T. haliotidea is recorded from Western Germany, Belgium, Switzerland, France, Italy, Dalmatia and Adriatic States, Corsica, Spain, Portugal, Algeria, Madeiras, and Canaries, but the confusion that has always reigned in this genus makes many of the specific identifications of doubtful accuracy.

It has also been recorded from Nova Scotia and from Philadelphia, U.S.A., doubtless introduced.

The distribution in the British Isles is probably very complete over the southern and western districts of England, but the records are incomplete and many unreliable; undoubted examples have, however, been found in various parts of England, the south of Scotland, the south and east of Ireland, and south of Wales.

ENGLAND AND WALES.

Channel Isles—Guernsey, first noticed in 1801 (F. C. Lukis, London's Mag., 1834, pp. 224-5, and figs.). Recorded as occurring abundantly in Guernsey and on Sark (Cooke & Gwatkin, Q.J.C., i., p. 331, 1878).

PENINSULA.

Cornwall W.—Rare in gardens, Newlyn, Heamoor, and Penzance (Marquand, Trans. Penzance N.H. Soc., 1884).

Devon S.—In garden of the garrison, Plymouth (Turton's Manual, 1831, p. 29). Kingsbridge: in garden, Torcross Hotel! also in gardens of Mr. J. Elliott! and others, W. E. Baily, June 10, 1886. The Castle, Tiverton, Capt. L. Moore (Webb, J. of Mal., July 1897, p. 25).

Devon N.—Dr. Turton's garden, Bideford (Turton's Manual, 1831, p. 29). Garden, Manor House, Lynton (C. F. Hill, Field, March 7, 1885, p. 307). Hele Bay, Ilfracombe, March 1886 (J. R. B. Tomlin, J. of Conch., v., p. 181, 1887).

Somerset S.—Gardens, Taunton (Tate, Brit. Moll., 1866, p. 86).

Somerset N.—Beckington, H. Franklin Parsons (Webb, Journ. of Mal., Dec. 1897, p. 49).

Wilts. S.—Frequent at Devizes, also Trowbridge (J. E. Vize, Wilts. Mag., ix., No. 27, p. 278, 1866). *CHANNEL.*

Dorset—Mr. Thompson's orchard-house, Weymouth (J. C. Mansel Pleydell, Conch. of Dorset, p. 111, 1885). Montevideo, Chickerell, N. Richardson (J. C. Mansel-Pleydell, Moll. Dorset, 1898, p. 2). Abundant in my garden at Stalbridge (H. J. Johnston Lavis, Sc. Gos., 1878, p. 209). The specimens recorded from Down House, Blandford, by J. C. Mansel-Pleydell, in Proc. Dorset Soc. for 1885, and elsewhere, are *T. maugei* Fér.

Sussex W.—Plentiful in Alman's Nursery, Horsham, May 1886! T. Whitaker. Garden, Ratham, near Chichester, Aug. 30, 1890! W. Jeffery.

Sussex E.—Not rare in gardens at Lewes, July 26, 1883! T. S. Hillman. Brighton, R. B. Sharpe! (British Museum, 1886). Garden, Park crescent, Brighton, 1879 (R. M. Christy, Zool., Aug. 1880, p. 367). *THAMES.*

Kent E.—Maidstone: gardens, London road; garden, adjoining St. Michael's Church; cemetery about one mile south-east of the town and near Tovil Station! Hubert Elgar, July 1891.

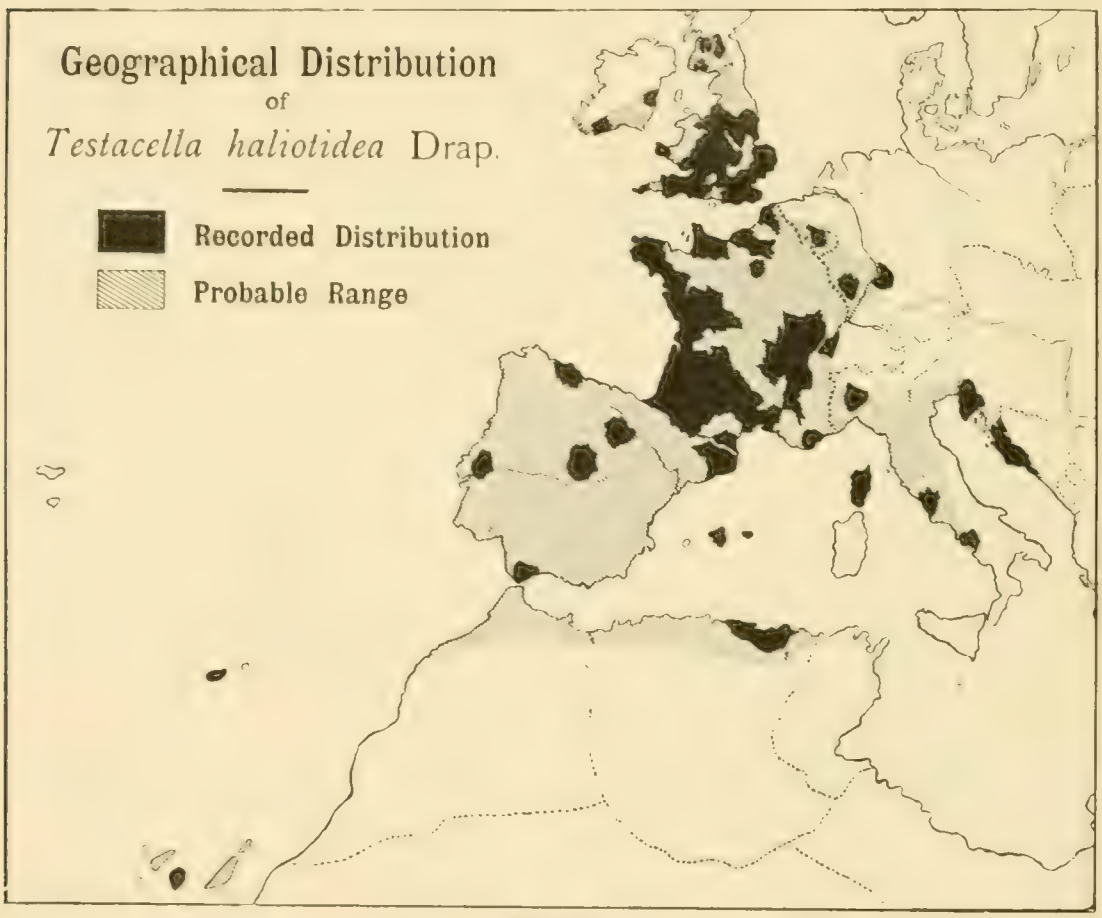


Fig. 19.

Kent W.—Shoreham Vicarage, Sevenoaks, R. Ashington Bullen (Webb, J. of Mal., 1897, p. 25). Kelsey Park, Beckenham, Mark Webster (Webb, J. of Mal., 1897, p. 49). Not rare in the garden of Holy Trinity Vicarage, Woolwich, Aug. 1889! J. W. Horsley.

Surrey—Asparagus beds, Nutfield Priory, J. Moffat; Surrey House, Leatherhead, C. A. Brigg; Sutton Common, Maxwell T. Masters; 11, Harrow road, East Dorking, C. J. Howell; and Kew Gardens (Webb, J. of Mal., Dec. 1897, p. 49). Wray Park, Reigate (G. S. & E. Saunders, 1861).

Essex S.—Widford Lodge, Widford, E. Hammond (Webb, J. of Mal., July 1897, p. 25).

Essex N.—Stisted, Basil F. May ; Colchester, W. Patterson (Webb, J. of Mal., July 1897, p. 25).

Herts.—Abundant in garden, Manor House, Hitchin, May 1890! F.W. Phillips.

Middlesex—Garden, Adelaide Road, Regent's Park, Sept. 1867, J. E. Harting (W. Jeffery, 1888 !) Greenhouse in Williams and Son's Nursery, Upper Holloway, Jan. 1897 ! G. K. Gude. Royal Horticultural Society's Gardens, Chiswick, E. Miller (Webb, J. of Mal., Dec. 1897, p. 49). Uxbridge, May 1891! C. H. Morris.

Berks.—Faringdon ! T. Rogers, 1885.

Oxon.—Garden, Wykeham House, Oxford, Feb. 1887 ! E. B. Poulton. Cabbage field, near St. Clement's Church, Oxford, 1887 ! S. Spencer Pearce. Garden on Headington Hill (S. Spencer Pearce, Zool., Sep. 1883, p. 363). Blenheim Palace Gardens, frequent, R. Rogers (W. D. Crick, March 1885). Middleton Park, Bicester, T. Trollope (Webb, J. of Mal., Dec. 1897, p. 49).

ANGLIA.

Bedford—Abundant in the south of the county, F. W. Phillips, May 1890.

Suffolk E.—Gardens, Woolverstone Park, Sept. 1887 ! J. Sheppard. Woodbridge, S. Spencer Pearce, May 1886. Dallinghoo Rectory, R. Ashington Bullen (Webb, Journ. of Mal., July 1897, p. 25). Blaxhall, G. T. Rope ! (Carleton Greene, Suffolk list, 1891).

Suffolk W.—Bury St. Edmund's, Mr. Norgate (Carleton Greene, Suffolk list, 1891).

Norfolk E.—Abundant in Mackie's Nursery Garden, Norwich ; garden, Ipswich road, Norwich (J. B. Bridgman, Zool., 1850, p. 49). Aylsham, near Norwich (Pearce & Mayfield, J. of Conch., July 1894, p. 393). Yelverton, May 1891 ! S. S. Pearce.

Norfolk W.—Diddington Hall, Brandon, A. Tanner (Webb, J. of Mal., July 1897, p. 25).

SEVERN.

Gloucester W.—Garden, Carrville, Alexandra Park, Bristol, May 1888 ! J. W. Cundall. Kingsdown Parade, W. W. Stoddart ; Clifton Gardens, Miss Jones ; and at Hampton Park, rare (Leipner's Bristol list, 1875, p. 280).

Monmouth—Plentiful at Mathern, near Chepstow, April 26, 1892 ! E. J. Lowe.

Hereford—Very rare, Burghill, T. A. Chapman (A. E. Boycott, Sci. Goss., April 1892, p. 78). Garden, Broomy Hill, Hereford (Boycott and Bowell, Woolhope Nat. Field Club, Oct. 1899, p. 24).

Worcester—Worcester, Oct. 30, 1888 ! S. Smith Hastings ; Diglish House, Worcester, S. Taylor ; also Elmfield, London road, Worcester, C. H. Webber ; and Hagley Hall, Stourbridge, D. R. Dixon (W. M. Webb, Journ. of Mal., July 1897, p. 25).

Stafford—Two found by T. Kirkby, of Hanford, near Trentham, Oct. 1897 ! also found by Mr. Nicklin in his garden at Trentham, Sept. 1897 (J. R. B. Masefield, J. of Conch., Jan. 1898, p. 8).

Salop.—Hatton Grange, near Shifnal, and Lilleshall Abbey, near Newport, T. C. Eyton, 1862 (W. E. Beckwith).

TRENT.

Lincoln N.—Garden, Highfield, Gainsborough, Apl. 22, 1898 ! F. M. Burton.

Notts.—Carlton Hall, Carlton-on-Trent, Louis Pope (Webb, J. of Mal., Dec. 1897, p. 49). Highfield House, Beeston (Dodd, Brit. Assoc. Handbk., 1893, p. 71). Introduced from Horsham, Sussex, into the gardens of Rainworth Lodge, Mansfield, in June 1886, by Mr. J. Whitaker. Welbeck Abbey, 1879, R. A. Rolfe (C. T. Musson, Midl. Nat., Feb. 1879).

MERSEY.

Cheshire—Arley Hall, Northwich, J. V. Smith (W.M. Webb, Journ. of Mal., July 1897, p. 25).

Lancashire S.—Clayton Hall, Accrington, J. Poulter (Webb, J. of Mal., Dec. 1897, p. 49). Near Crumpsall, 1862, T. Glover (Melvill, Handbook Brit. Assoc., Manchester, 1887, p. 84). Knowsley, near Liverpool (Collinge, J. of Mal., June 24. 1893, p. 148).

HUMBER.

York S.E.—Swailes' Nursery Garden, Beverley ! J. D. Butterell, 1883.

York S.W.—Sandbeck Park, Rotherham, G. Summers, and Wath-on-Dearne, W. McKeigh Jones (Webb, J. of Mal., July 1897, p. 25). Orchard-house, Ferniehurst, Shipley, March 1892 ! E. Self.

SOUTH WALES.

Pembroke—Tenby, A. G. Stubbs, Feb. 1896.

SCOTLAND. *WEST LOWLANDS.*

Renfrew—Woodside Gardens, Paisley, Chas. Hogg, Oct. 1898.

Kirkcudbright—Common in Corberry Nurseries, Maxwelltown, April 1890 ! R. Service.

EAST HIGHLANDS.

Stirling—Brentham Park, Stirling, D. Bruce (W. M. Webb, Journ. of Mal., July 1897, p. 25).

IRELAND. *LEINSTER.*

Dublin—Greenhouse, Trinity College Botanic Gardens, Dublin, W. F. Burbridge, 1895 (R. F. Scharff, Irish Nat., March 1895, p. 80); Royal Botanic Gardens, Glasnevin, Dublin, W. F. Moore, 1895! (R. F. Scharff, Jan. 1902). *MUNSTER.*

Cork N.—Town gardens, Youghal, 1835, Miss Ball! (R. F. Scharff, 1888); garden, Baudon, G. J. Allman; also at Vosterberg, Councillor Reeve's residence, Cork, by D. Murray, the gardener, who had observed them for several years past (J. D. Humphreys, Cork Fauna, 1845, p. 2).

GERMANY.

Occurs on German territory, but only in the western region. Metz, Lothringen, larger than the examples from south-west France (Gassies & Fischer, 1856, p. 69). Formerly found in Mons. Simon's garden, Plantières, but not in recent years (Meyer, Nacht. Deutsch. Mal. Ges., 1876, p. 36). Castle Garden, Heidelberg, Baden (Daniel, Q. J. C., i., p. 113, 1876).

BELGIUM.

In gardens at Fonds-de-Leffe, near Dinant, M. Julien Deby (Colbeau, Ann. S. Mal. Belg., 1865, p. 109).

FRANCE.

Ain—Rare, Sathonay, Rillieux, Miribel (Locard, Moll. de l'Ain, 1881, p. 15).

Allier—Rare by the Chateau of Montgarnaud, near Moulins (Wattebled, J. de Conch., 1881, p. 327).

Calvados—Caen, in many gardens, notably the Botanic Gardens; Colleville-sur-Orne, E. Deslongchamps (A. de l'Hôpital, Moll. Caen, 1859, p. 8).

Charente Inférieure—Rochelle, la Faille in 1754 (Fér., Hist. Moll., 1819, p. 94).

Deux Sèvres—Niort by Guillemeau in 1754 (Fér., Hist. Moll., 1819, p. 94)

Dordogne—Gass. & Fisch., 1856, Perigord (Lacaze-Duthiers, Hist. Test., 1887).

Drôme—Environs of Crest, Faure-Biguet; Montélimar, Loriol, etc. (Drap., Hist. Moll., 1805, p. 152); Wood at St. Vincent-sur-Charpey, alt. 700 mètres (G. Sayn, Cat. Moll. Drôme, 1888, p. 130).

Finistère—Commoner than *T. maugei* in the botanical and other gardens, Brest; Moulin-Blanc; especially common in the cabbage-fields near the guard-house of Fort Bouguen (Daniel, J. de Conch., 1883, p. 376). Common in gardens at Landerneau (Bourg., Mal. Bret., 1860, p. 87). Roscoff (Lacaze-Duthiers, Hist. Test., 1887).

Gard—Nimes, Pont-St.-Esprit, Auzon, Servas (Clement, Moll. Gard, 1878).

Garonne, Haute—St. Bertrand de Comminges, Toulouse (Boubée, t. Fagot, 1880), also at Cierp, near Chignac road, common in garden at Gaud, near Cierp, M. Parenteau (St. Simon, 1876).

Gers—Common in gardens and woods at Auch, Lectoure, Bivès, Duran, Montaut, etc. (Dupuy, Moll. Gers, 1843, p. 10). Old Tower, Barbotan, rare (Dupuy, J. de Conch., 1877, p. 20).

Gironde—Botanical Gardens, Bordeaux, also at Ambares (Des Moulins, Moll. Gironde, 1827, p. 7).

Hérault—Montpellier (Draparnaud, Hist. Moll., 1805, p. 152), Villeneuve, St. Martin-de-Londres, Bédarieux, etc. (Dubrueil, Moll. Hérault, 1863, p. 4).

Isère—St. Fond, M. Faujas (Drap., Hist. Moll., 1805, p. 152).

Jura—Old cemetery of Lons-le-Saunier (Ogerien, Hist. Nat. Jura, 1863, p. 506).

Landes—(Grateloup, Dist. Geog. Limac., 1855).

Loire, Haute—Very abundant (Pascal, Moll. Haute Loire, 1873, p. 23).

Loire Inférieure—Croisic, M. de Querhoent, 1779 (Fér., Hist. Moll., 1819, p. 94). Common at Cléons and at Le Plessis, Frossay, also in gardens at Bois-Branlard, in Chantenay, at the Folies-Chaillon, and Toutes-Toies, all near Nantes (Cailliaud, Cat. Moll. Loire-Infér., 1865, p. 206). Cultivated ground especially cabbage-gardens at Croisic, and at village of Batz (Bourg., Mal. Bret., 1860, p. 28).

Lot—(Férussac, t. Gassies & Fischer, 1856).

Lot et Garonne—(Férussac, Hist. Moll., 1819, p. 94).

Maine et Loire—Angers, in Botanic Garden, at la Chalouère, les Fourneaux, etc., Dampierre, Montreuil-Bellay, Saumur, Doué, Beaulieu, etc. (Millet, Moll. Maine et Loire, 1854, p. 13).

Manche—St. Lô (R. le Clerc, Not. Mem. Docum. Soc. Manche, xv., p. 145).

Morbihan—Common in gardens at Roche-Bernard; Bröel, near Muzillac; Vannes, and in the Park, Roguedas (Bourg., Mal. Bret., 1860, p. 45).

Nord—Valenciennes (Baudon, J. de C., July 1884, p. 210).

Oise—Garden of Madame Nô, Beauvais, 1879 (Baudon, J. de C., July 1884).

Distribution of *T. haliotidea* Drap.

In the Counties and Vice-Counties of the British Isles.

ENGLAND AND WALES.

Channel Isles

PENINSULA
1 Cornwall W.
2 Cornwall E.
3 Devon S.
4 Devon N.
5 Somerset S.
6 Somerset N.

CHANNEL
7 Wilts N.
8 Wilts S.
9 Dorset
10 Isle of Wight
11 Hants S.
12 Hants N.
13 Sussex W.
14 Sussex E.

THAMES
15 Kent E.
16 Kent W.
17 Surrey
18 Essex S.
19 Essex N.
20 Herts.
21 Middlesex
22 Berks.
23 Oxford
24 Bucks.

ANGLIA
25 Suffolk E.
26 Suffolk W.
27 Norfolk E.
28 Norfolk W.
29 Cambridge
30 Bedford
31 Hunts.
32 Northampton

SEVERN
33 Gloucester E.
34 Gloucester W.
35 Monmouth
36 Hereford
37 Worcester
38 Warwick
39 Stafford
40 Salop

SOUTH WALES
41 Glamorgan
42 Brecon
43 Radnor
44 Carmarthen
45 Pembroke
46 Cardigan

NORTH WALES
47 Montgomery
48 Merioneth
49 Carnarvon
50 Denbigh
51 Flint
52 Anglesey

TRENT
53 Lincoln S.
54 Lincoln N.
55 Leic. & Rutld.
56 Notts.
57 Derby

MERSEY
58 Cheshire
59 Lancashire S.
60 Lancashire Mid

HUMBER
61 S.E. York
62 N.E. York
63 S.W. York
64 Mid W. York
65 N.W. York

TYNE
66 Durham
67 Northumb. S.
68 Cheviotland

LAKES
69 Westmorland and L. Lancs.
70 Cumberland
71 Isle of Man

SCOTLAND.

W. LOWLANDS
72 Dumfries
73 Kirkcudbright
74 Wigtown
75 Ayr
76 Renfrew
77 Lanark

E. LOWLANDS
78 Peebles
79 Selkirk
80 Roxburgh
81 Berwick
82 Haddington
83 Edinburgh
84 Linlithgow

E. HIGHLANDS
85 Fife & Kinross
86 Stirling
87 Perth S. & Clkn
88 Mid Perth
89 Perth N.
90 Forfar
91 Kincardine
92 Aberdeen S.

E. HIGHLANDS
93 Aberdeen N.
94 Banff
95 Elgin
96 Easterness

W. HIGHLANDS
97 Westerness
98 Main Argyle
99 Dumbarton
100 Clyde Isles
101 Cantire
102 Ebudes S.
103 Ebudes Mid
104 Ebudes N.

N. HIGHLANDS
105 Ross W.
106 Ross E.
107 Sutherland E.
108 Sutherland W.
109 Caithness

NORTH ISLES
110 Hebrides
111 Orkneys
112 Shetlands

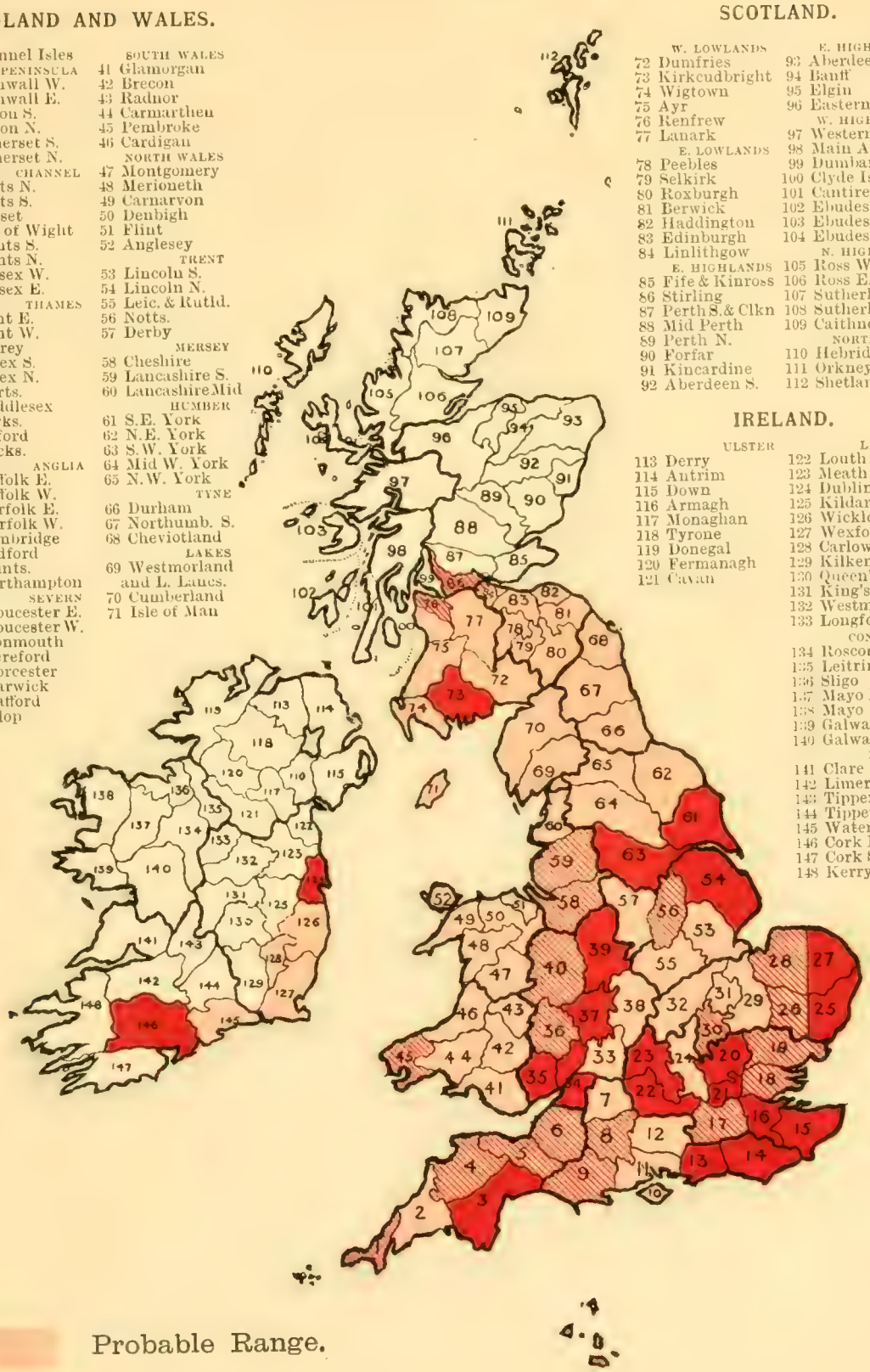
IRELAND.

ULSTER
113 Derry
114 Antrim
115 Down
116 Armagh
117 Monaghan
118 Tyrone
119 Donegal
120 Fermanagh
121 Cavan

LEINSTER
122 Louth
123 Meath
124 Dublin
125 Kildare
126 Wicklow
127 Wexford
128 Carlow
129 Kilkenny
130 Queen's Co.
131 King's Co.
132 Westmeath
133 Longford

CONNAUGHT
134 Roscommon
135 Leitrim
136 Sligo
137 Mayo E.
138 Mayo W.
139 Galway W.
140 Galway E.

MUNSTER
141 Clare
142 Limerick
143 Tipperary N.
144 Tipperary S.
145 Waterford
146 Cork N.
147 Cork S.
148 Kerry



Probable Range.

Recorded Distribution.

Distribution verified by the Authors.

Pas-de-Calais—Boulogne (Baudon, J. de C., July, 1884).

Puy-de-Dôme—Common in Puy-de-Dôme (Bouillet, Moll. Auvergne, 1836, p. 19).

Pyrénées, Hautes—Dupuy (Gassies & Fischer, 1856).

Pyrénées, Basses—Gardens and along the ditches, Bilhères, rare (Mermet, Hist. Moll. Pyr. Occ., 1843, p. 18). Bramepan (Folin & Beril., Mal. S. O. France, 1877). Bayonne (Pollonera, Boll. Mus. Zool. Torino, 1888, p. 2).

Pyrénées Orientales—Oleron, Massot (Gassies & Fischer, 1856, p. 50). Amelie-les-Bains, 1887, R. D. Darbishire ! Banyuls (Lacaze-Duthiers, Hist. Test., 1887).

Rhône—Lyon, M. Lyonnet (Férussac, Hist. Moll., 1819, p. 94). In hilly regions, Mont d'Or, St. Symphorien d'Ozon, Caratte, etc. (Locard, Mal. Lyonnaise, 1877, p. 6).

Saône et Loire—Not rare in spring and autumn in calcareous earth in the hilly districts (Grognot, Moll. Saône et Loire, 1863, p. 9).

Seine—Jardins du Luxembourg and Val-du-Grace, Raymond (Gassies & Fischer, 1856). Jardin des Plantes (Lacaze-Duthiers, Hist. Testacelle, 1887).

Seine Inférieure—First observed in France, at Dieppe, in 1740, by Dugué.

Tarn—Sorèze, M. Duclos (Draparnaud, Hist. Moll., 1805, p. 152).

Tarn et Garonne—(Fér., Hist. Moll., 1819, p. 94). Quercy (Lacaze-Duthiers, Hist. Test., 1887).

Vendée—Environs of Fontenay (Letourneaux, 1869, p. 10). Ile de Noirmoutier (Lacaze-Duthiers, Hist. Test., 1887).

Vienne—Common on chalky, arid, and stony soils at La Vergne, at the Grange-au-Rondeau, and in gardens at Poitiers (Mauduyt, Moll. Vienne, 1839, p. 25).

SWITZERLAND.

Enumerated for Geneva (Jurine, Ess. Stat. Genève, 1824).

CORSICA.

Bastia, Blauner (Requien, Cat. Moll. Corse, 1848, p. 43).

ITALY.

Not rare in the ditches of Castle St. Angelo, Rome (Statuti, Bull. Soc. Mal., 1882, p. 15). Villa Doyen, Cavoretto near Torino, Piedmont (C. Pollonera, Boll. Mus. Zool. Torino, March 31, 1899). Sorrento, Campania, McAndrew Collection, Cambridge (Brockton Tomlin, 1886).

AUSTRO-HUNGARY.

Istria, at Trieste (E. v. Martens, 1888). Goritz, at Görz (Heynemann, Jahrb. Deutsch. Mal. Ges., June 1885, p. 254). Dalmatia, Schröckinger (Jeffr., Brit. Conch., 1869, v., p. 156).

SPAIN AND PORTUGAL.

Spain—Madrid (Graells, Moll. España, 1846, p. 1). Asturias (Fischer, Manuel de Conch., 1883, i., p. 202). In Catalonia, at Barcelona (Bofill, Moll. Barcelona, 1879); Olot and Bosch de Tosca (Salvana, Moll. Catal., 1888); Gerona, (Chia, Moll. Gerona, 1886); and at Valvidrera (Fagot, Mal. Valvidrera, 1884). In Old Castile, at Sarria (Martorell y Pena, Col. Conch., 1888); and in Andalusia, at Gibraltar, Dec. 1884. J. W. Horsley !

Balearic Isles—Majorca, and in Minorca at Mahon, San Cristobal and Ferrarias (Hidalgo, J. de Conch., 1878).

Portugal—(Hidalgo, J. de Conch., 1877, p. 254).

NORTH AFRICA.

Algeria—Bougie (Webb & Berthelot, Hist. Nat. Canaries, 1834, p. 48). Philippeville and Bona, not common (Morelet, Moll. Port., 1845, p. 49).

ATLANTIC ISLES.

Canary Isles—Gran Canaria (R. Boog Watson, J. de Conch., 1876, p. 221).

Madeira—Gardens, Funchal, said to have now disappeared (R. Boog Watson, J. de Conch., 1876, p. 221).

NEARCTIC REGION.

Canada—One specimen in a greenhouse in Nova Scotia (Binney, 1878, p. 27).

United States—Lincoln Park, Philadelphia (F. C. Baker, Nautilus, Sept. 1901, p. 59). Very plentiful, Roxborough, near Philadelphia (H. A. Pilsbry, May 1894).

Testacella scutulum G. B. Sowerby.

1823 **Testacella scutulum** Sow., Gen. Shells, pl. 159. ff. 3-6.
1826 — *bisulcata* Risso, Hist. Nat. Europe Merid., pl. 4, p. 58.
1855 — *galloprovincialis* Grateloup, Dist. Geog. Limaciens, p. 15.
1855 — *anglica* Grat., Dist. Geog. Limac., p. 15.
1855 *haliotidea* var. *scutulum* Moq. Tand., Moll. France, ii., p. 39; Jeffreys, Brit. Conch., i., 1862, p. 145, pl. 5, f. 7.
1856 — *medii-templi* Tapping, Zool., p. 5105.
1861 — *fischeriana* Bourg., Rev. Mag. Zool.
1861 — *pecchiolii* Bourg., Rev. Mag. Zool., p. 517.
1873 — *gestroi* Issel, Ann. Mus. Civico, Genova, p. 277, ff. 1-5.
1880 — *williamsiana* Nevill, Proc. Zool. Soc., p. 101. pl. 13. f. 1.
1838 *Testacellus scutatus* Lesson, Rev. Zool., i., p. 249.

HISTORY.—*Testacella scutulum* (*scutulum*, a little shield) was first found in a garden in Kennington road, Lambeth, Surrey, by Mr. G. B. Sowerby, who figured and described it in his "Genera of Recent and Fossil Shells," published in 1823.

The superficial resemblance of this species to *haliotidea*, and the complete ignorance at this period of its striking structural peculiarities, soon led to Sowerby's species being universally regarded as only a slight variety of *haliotidea*, until 1888, when the publication of Mr. Charles Ashford's accurate drawings of its internal organization definitely established its specific status.

In our English text-books, *Testacella scutulum* or *Testacella haliotidea* are indiscriminately figured as representing the latter species. Dr. Gwyn Jeffreys, in his "British Conchology," though undoubtedly representing *T. haliotidea* in vol. i., at f. 6, pl. 5, yet figures albeit roughly the shell of *T. scutulum* at f. 7, and also in the Supplement to his work.

Lovell Reeve, in his "British Land and Freshwater Mollusks," gives as the generic figure on p. 27 a copy of Sowerby's original figure of *Testacella scutulum*, but at p. 30, under *T. haliotidea*, figures an animal which cannot with propriety be referred to any of our British species of *Testacella*, although the figures of the shell are good representations of those of *T. scutulum*.

Testacella scutulum may be regarded as linking together *Testacella haliotidea* and *Testacella maugei*, as, although curiously similar to *T. haliotidea* in some external points, it is yet not so advanced in its internal structure, which in certain important respects has more affinity with that of *T. maugei*; the south European examples approximate still more closely in showing fewer lateral muscles to the lingual sheath than are normally present in British examples.

Diagnosis.—*Testacella scutulum* may be readily differentiated from its congeners when the animal is extended by the confluent origin of the lateral grooves, a trifle in advance of, but joined with, the peripallial furrow: the usually yellow colour of the body, and the smaller shell, which is flat or even concave on the upper surface, with a broad, angularly concave, and almost truncate columella.

Internally, it differs from *haliotidea* in the absence of the flagellum to the penis-sheath, and from *maugei* by the possession of numerous lateral muscles to the lingual sheath.

Description.—ANIMAL tawny-yellow, more or less freely speckled with brown, especially on the back; SOLE and FOOT-FRINGE orange-yellow, most vivid near the tail; LATERAL GROOVES distinct and originating in a common depression in advance of, but connected with, the peripallial furrow; the mid-dorsal sculpture so distinct in *T. maugei* is only very faintly indicated. When contracted it usually assumes a semi-globose form somewhat dissimilar to the lenticular shape of *haliotidea* or the short, cylindrical aspect of *maugei*.

SHELL narrowly auriform, UPPER SIDE flat or even actually concave, LINES OF GROWTH comparatively fine, PERIOSTRACUM rusty-brown, and more persistent than in *maugei* or *haliotidea*, the colour showing internally through the thin outer margin of shell; NUCLEUS nearly central, placed at an angle of 60 to 70 deg. to the vertical line of the shell; COLUMELLA glossy-white, broad and angularly concave, terminating abruptly at the anterior margin of the shell. Length, 7 mill.; the greatest width, about 4 mill., being about the middle of the shell; alt., $1\frac{1}{2}$ mill.

INTERNALLY, the ALIMENTARY SYSTEM displays a short ŒSOPHAGUS, which opens into a somewhat brownish CROP, 12 or 14 mill. long, which shows longitudinal whitish stripes, due to longitudinal plaits within; the paired white SALIVARY GLANDS are 5 or 6 mill. long, attached to its sides, and do not blend together; the VESTIGIAL STOMACH is of a purplish colour, about 3 mill. in diam., and is placed at first bend of gut, just before receiving the stout and white bile ducts; the GUT, which is very thick and firm, traverses the digestive gland, afterwards narrowing into a slender rectum, which opens as usual on the right side beneath the shell.

The REPRODUCTIVE ORGANS simple; OVOTESTIS flesh-coloured with long acini and imbedded within digestive gland; DUCT whitish, convoluted throughout, and entering the albumen gland about the middle, from whence to outlet it is fused to gland; ALBUMEN GLAND large and broad, ochreous or reddish amber; OVISPERMATODUCT wide and compressed, the two channels well united; OVIDUCT in many broad, close-set plaits; SPERM-DUCT broad throughout and of a buff colour; VAGINA very long, slender below, much dilated above and abruptly doubly-flexed; SPERMATHECA globular, reddish-brown, with dull white mottlings when mature, closely attached to the middle of ovispermatoduct; stem of spermatheca comparatively short and bent, slender above and gradually enlarging to base; VAS DEFERENS long and simple, entering the penis sheath at its apex close to the retractor; PENIS SHEATH long and opaque-white, narrow at base, but increasing in diameter as it passes upwards, the upper half broad and rigidly doubly flexed; RETRACTOR very long and ribbon-like, passing freely over the dorsal surface of visceral mass and affixed near shell at caudal end of body; ATRIUM very short.

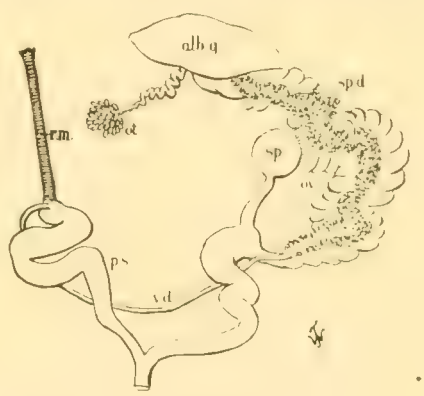


FIG. 21.—Sexual organs of *T. scutulum* × $1\frac{1}{2}$. (Chiswick, Mr. S. C. Cockerell).

alb.g. albumen gland; *ot.* ovotestis; *ov.* oviduct; *p.s.* penis sheath; *r.m.* retractor muscle; *sp.* spermatheca; *sp.d.* sperm duct; *v.d.* vas deferens.

The RETRACTORS of the tentacles are shorter than those of *T. haliotidea* or *T. maugei*, and more exactly symmetrically in their points of attachment to the integument close to the junction of the sole with the sides of the body; they run free, as usual, along each side of the lingual sheath, dividing into the usual two branches for upper and lower tentacles before reaching brain ring; the bands are ribbon-like and of nearly uniform width throughout, but spreading at the roots for firmer hold.

FIG. 22.—Lingual sheath of *T. scutulum* × $1\frac{1}{2}$, Hornsey, collected by Mr. H. Wallis Kew, illustrating the retractor muscles of the tentacles and lingual sheath.

The LINGUAL SHEATH is enormous, forming a firm, tough, pearly body, anteriorly nearly cylindrical, but tapering off behind into a very powerful muscle, composed of two, three, or four partially independent muscles, as in *T. maugei*, and having in addition its hinder half attached laterally to the skin of the left side by a series of five to ten pairs of conspicuous muscular bands running parallel to each other and fixed at independent points.

The LINGUAL TEETH are very long, comparatively slender, slightly curved, apex distinctly barbed or hamate, the median apophysis markedly nearer the basal end, and the teeth apparently deficient of the cutting blade, present upon the convex side

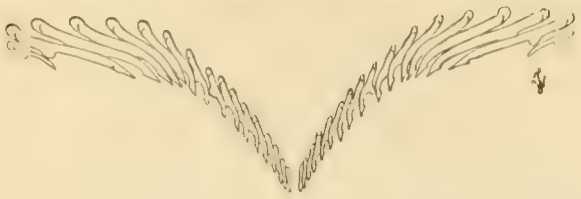


Fig. 23.—Transverse row of teeth from the odontophore of *Testacella scutulum* × 20, from Chiswick, collected by Mr. S. C. Cockerell; figured from a photograph.

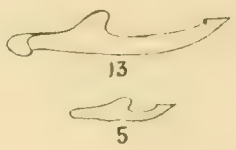


Fig. 24.—Isolated teeth from the fifth and thirteenth longitudinal rows of the radula of *T. scutulum* × 10.

of the teeth of *haliotidea* at the apical end. The angle formed by the convergence of the rows of teeth towards the centre of the radula is more acute than in *T. maugei*, but less than in *haliotidea*, and the vestigial median row of teeth can occasionally be discerned.

The dental formula of a Chiswick specimen, collected by Mr. S. C. Cockerell, is $\frac{17+0+0+0+17}{1 \quad\quad\quad 1} \times 46 = 1564$.

Reproduction and Development.—The cretaceous eggs of this species are deposited underground, and are not numerous, they are distinctly oval in shape, about five mill. long by three mill. broad, white or very pale pink when first deposited, soon, however, becoming of a brownish-white colour. They have been found in this country as early as February. Hatching takes place in from twenty to thirty-six days, the young attaining full growth in about eighteen months.

Fig. 25.—Egg of *T. bisulcata* × 1½ (after Gassies & Fischer).

Gassies & Fischer describe the egg of *T. bisulcata* as round and about the size of No. 2 shot, but their figure has a distinctly oval outline, similar to that of *T. scutulum*.

Habits.—Gassies & Fischer remark, under the heading of *T. bisulcata*, that this species is less in the habit of leaving its subterranean retreat than its congeners, and ascribe its less frequent capture to this cause. Mr. Kew, however, remarks that he somewhat frequently sees *T. scutulum* during the spring and autumn months crawling about in the early morning, or even at mid-day, at the foot of the low garden-walls in the north London suburbs. The sluggish movements and the usual tawny colour of the body tend to be protective upon stony soils and gravelled garden pathways.

Parasites and Enemies.—Mr. H. E. Quilter was fortunate in detecting upon *T. scutulum*, from Belvoir, examples of a species of mite, which were evidently parasitic, and which he describes as having a round, hairy and shiny white body, with four pairs of five-jointed, hairy, ambulatory legs terminated by small claws, mouth with cephalic appendages or chelicerae.

Geological History.—No record of its occurrence in the fossil state is known to me, but I do not hesitate to include with this species the *T. williamsiana* Nevill, and the *T. auriculata* Gass. & Fisch. The *T. williamsiana* is from the Holocene conglomerate of the caves of Mentone, near gorge of St. Louis, in the Alpes Maritimes, the author differentiating it from *T. bisulcata* by its almost vertically prominent central apex and its regular, close, and deep sulcations. The *T. auriculata* G. & F.

Fig. 26.

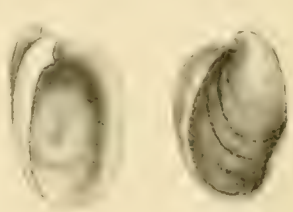


Fig. 27.

Fig. 26.—*Testacella williamsiana* Nevill, × 4 (after Nevill).

Fig. 27.—*Testacella auriculata* Gass. & Fisch., × 3½ (after Gassies & Fischer).

seems to be merely an abnormal specimen found fossil at Vendôme in the department of Loir-et-Cher, described by its author as differing from all its congeners by its solid and flat auriculate shell and thickened margins.

Variation.—This species, which has been misunderstood almost from the time of its discovery, and whose specific characters are even yet not universally appreciated, has in its various forms been described again and again as new by different authors, and although Gassies & Fischer and Moquin-Tandon expressly allude to *T. scutulum*, it is not at all clear that they had the true *T. scutulum* before them.

In this country *T. scutulum* is moderately constant in the form of its shell and the colour of its body, but abroad this consistency of type is not so fully maintained, if the allocation, as suggested by Simroth, of *campanyoi* and other forms to the *scutulum* series be correct.

VARIATIONS IN FORM OF SHELL.

Var. **pecchiolii** Bourg., Rev. et Mag. Zool., 1861, p. 517.

Animal yellowish, with a multitude of minute greyish dots on the back; lateral furrows separate at their origin at the peripallial groove.

Shell narrower and more elongate; columella not truncate and less arcuate; apex rather pointed and more detached. Length, 6 mill.; breadth, 3½ mill.

Testacella pecchiolii is the *T. haliotidea* of the older Italian authors, and is essentially an Italian form; most of the Italian records of *T. haliotidea* are possibly more properly referred to this variety.

Fig. 28.—*Testacella pecchiolii* Bgt. × 3 (after Bourg.).

Italy—Found in the garden of Signor Pecchioli, at Settignano, near Florence; also at Pisa, Bologna, and Rome. It is met with in Venetia and Lombardy; also on the slopes of Monte Cuccia, near Palermo, in Sicily, and the Isle of Ustica (Bourg., Gen. Test., 1862, p. 61). Apuan Alps, in Tuscany (Stefani, Boll. Soc. Mal. Ital., 1875).

Var. **major** G. & F., Monog. Testacelle, 1856, p. 46, pl. 2, f. 5D.

Testacella bisulcata var. *major* G. & F., op. cit., p. 46.
Testacella fischeriana Bourg., Rev. et Mag. Zool., Dec. 1861, pl. 13, ff. 5-7.

Animal larger and darker coloured than the typical form, with a sharply-defined yellow foot-fringe.

Shell larger and more oval, broadest at its posterior third, anterior end rounded; columella more arcuate and scarcely truncate. Length, 6 mill.; breadth, 4¼ mill.

Fig. 29.—*Testacella bisulcata* var. *major* × 3, G. & F. (after Gass. & Fisch.).

Algeria—Environs of Philippeville and Constantine (Bourg., Mal. Alger., 1864, p. 60). Not common on the glacis of the fortifications of Bab-Azoun and Bab-el-Oued (Lallemant, Ann. S. Mal. Belg., 1868, p. 5). Environs of Alger (Lallemant, Moll. Alger, 1881, p. 2).

VARIATIONS IN COLOUR OF ANIMAL.

Var. **albina** G. & F., Monog. Testacelle, 1856, p. 46.

Testacella bisulcata var. *albina* G. & F., op. cit., p. 46.
Testacella scutulum var. *pallida* Cockerell, Sci. Goss., 1885, p. 225.

Animal yellowish or whitish.

Middlesex—Chiswick, 1885! T. D. A. Cockerell. Hampstead lane, Highgate! Ferme Park road, and Weston Park, Hornsey! H. Wallis Kew.
Lancashire S.—Cuerden Hall, Preston, Jan. 1893! W. H. Heathcote.
York Mid W.—Dr. Eddison's garden, Adel, Leeds, Nov. 1896! H. Crowther.
Leicestershire—Belvoir Castle gardens, Jan. 1888! W. Ingram.
Louth—Piperstown, near Drogheda, Feb. 1890! Miss Sidney Smith.
Algeria—Constantine (Gass. & Fisch., op. cit.).

Var. **aurea** Cockerell, Sc. Goss., 1885, p. 225.

Animal orange-coloured with brown mottlings; foot-sole bright orange.

Middlesex—Chiswick, 1885! T. D. A. Cockerell.
Sussex W.—Horsham, 1902! R. D. Darbishire.

Geographical Distribution. The European area of distribution of this species cannot be stated with accuracy owing to the very prevalent misconception of its characters.

Under Risso's name of *T. bisulcata*, this species has, however, been recorded as being very common throughout the south of France, and as inhabiting Italy, Spain, and Algeria.

Fig. 30.—*Testacella bisulcata* Risso × 2 (after Dupuy).

Testacella pecchiolii, *T. gestroi*, *T. fischeriana*, and probably other south European forms are, if not absolutely identical, closely allied and more primitive forms of our species, and may be regarded as varieties.

The British distribution of *T. scutulum* is less restricted than that of the other species; it has been found scattered over England, and its existence verified in Ireland and Scotland, but it would seem to be especially prevalent in and characteristic of the Metropolitan district.

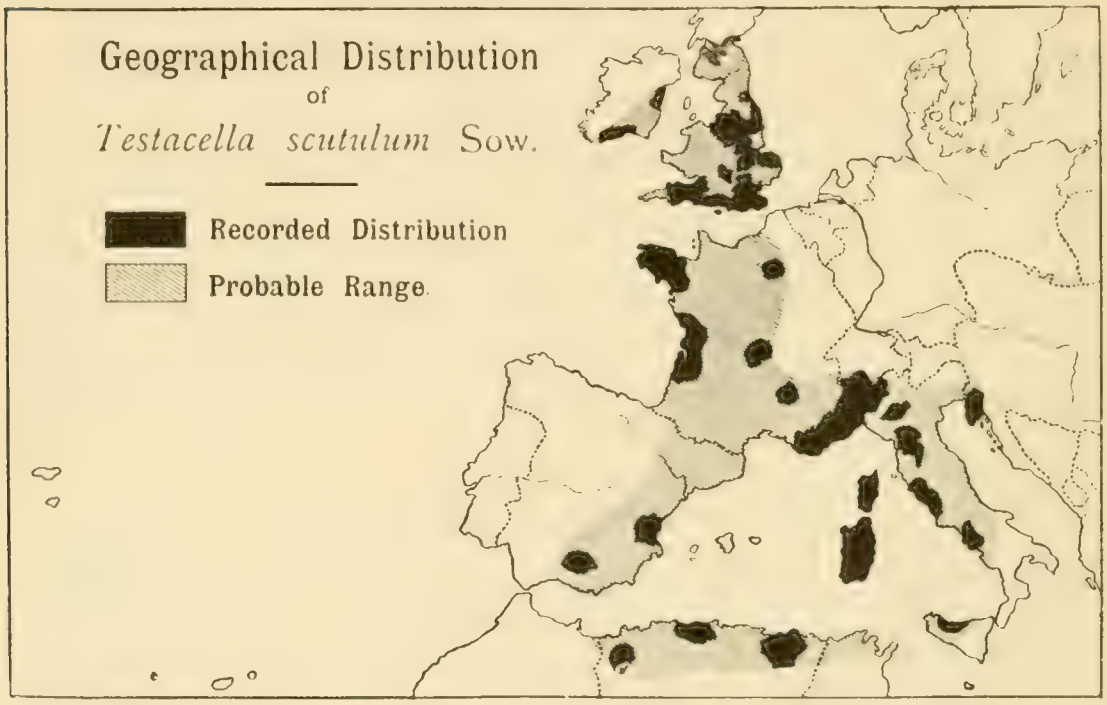


Fig. 31.

ENGLAND AND WALES.

Channel Isles—Market gardens, near St. Peter's Port, Guernsey! and in the Seigneurie grounds, Sark, A. H. Cooke, Feb. 1888.

PENINSULA.

Devon S.—Gardens, Plymouth (Alder, Mag. Zool. and Bot., 1838).

Devon N.—Gardens, Bideford (Alder, Mag. Zool. and Bot., 1838).

Somerset S.—The *Testacella* from Taunton, figured and recorded as *T. scutulum* (Nat., vii., p. 179) is *T. maugei* (Norman, Moll. Somerset, 1860).

Somerset N.—Leigh Woods, rare, T. G. Ponton, 1862 (Leipner's Bristol list, 1875).

CHANNEL.

Dorset—Chickerell, near Weymouth! E. R. Sykes, 1890.

Isle of Wight—Numerous in gardens, Newport (W. Jeffery, J. of Conch., iii., p. 313, 1882).

Sussex W.—Nursery garden, Chichester, June 1889! W. Jeffery. Introduced from Newport, I. of W., into garden at Ratham, near Chichester, about 1880 (W. Jeffery, J. of Conch., iii., p. 313, 1882). Horsham! R. D. Darbishire, 1902.

Sussex E.—Lewes, Dec. 1888! J. H. A. Jenner.

THAMES.

Kent W.—Mabledon, Tonbridge, Nov. 1887! A. H. Cooke. Garden, Maidstone, H. Elgar, June, 1891.

Kent E.—Folkestone and near Faversham, 1884! Miss E. B. Fairbrass.

Surrey—The original locality where this species was obtained by Mr. Sowerby is Kennington road, Lambeth. The specimens in the British Museum, labelled "*T. haliotidea*, Surrey," and "*T. haliotidea*, Lambeth," should be labelled "*T. scutulum.*" Nutfield Priory, with *T. haliotidea*, J. Moffat; also Crescent Wood House, Sydenham Hill, John Prince (Webb, J. of Mal., July 1897, p. 26). Park Hill Rise, Croydon, H. F. Parsons (Webb, op. cit., Dec. 1897, p. 49). Very common about 1860, in Ivery's Nurseries, Dorking! 1885, R. D. Darbishire. Kew Gardens, and garden at 66, Gloucester road, Kew, April 1884! R. A. Rolfe. Under beech leaves, Headley lane, near Boxhill, April 1886! T. D. A. Cockerell. Mitcham, Sept. 1884, Kenneth McKean.

Herts.—B. Piffard's garden, Hemel Hempstead, Feb. 1884! J. Hopkinson. Chase Side, Enfield, known for the past thirty years, F. Wright; abundant, Hemel Hempstead Nurseries, W. Foden (Webb, J. of Mal., July 1897, p. 26).

Middlesex—Middle Temple Gardens, first noted about 1846; the specimens from this locality were the types of *T. medii-templi* (T. Tapping, Zool., 1856, p. 5105).

Upper Holloway: Giesbach road! and garden of Upper Holloway Railway Station, April 1888! H. Wallis Kew.

Highgate: Hampstead lane, Dec. 1888! Archway road! and Shepherd's Hill road, H. Wallis Kew, Nov. 1901.

Hornsey: common, Ferme Park road, Oct. 25, 1901! Weston Park, Jan. 12, 1902! and Crouch End Hill, Hornsey! H. Wallis Kew.

Stroud Green: Hanley road! and Stapleton Hall road, H. Wallis Kew, Nov. 1901. Winchmore Hill, 1884, L. E. Adams.

Stoke Newington: occasionally in gardens (E. R. Allen, Field, 1885, p. 282).

Stamford Hill: first observed in 1829 (T. Blair, Loudon's Mag., 1833).

Regent's Park: plentiful in Royal Botanic Gardens (J. McIntosh, Nat., 1853).

St. John's Wood: Circus road and Adelaide road (J. E. Harting's Rambles, 1875).

Haverstock Hill: occasionally found from 1861-1881 in a garden formed on the site of a nursery garden, W. C. Atkinson, 1885.

Hampstead and Hendon: in fields and gardens (J. McIntosh, Nat., 1853).

Finchley: path from East Finchley to Hampstead, H. Wallis Kew, Nov. 1901.

Whetstone: in C. F. Minor's garden (T. D. A. Cockerell, Field, 1885, p. 607).

Turnham Green: formerly abundant at Burlington Cottage, S. S. Pearce, 1885.

Isleworth: Worton Hall Gardens, not common, A. Pentney (Webb, J. of Mal., July 1897, p. 26).

Chiswick: Royal Horticultural Society's Gardens, E. Miller (Webb, J. of Mal., Dec. 1897, p. 49); common in gardens, Woodstock road, 1885! T. D. A. Cockerell; the specimens in the British Museum labelled "*T. haliotidea*, Chiswick," are incorrectly named, and should be referred to the present species.

Ealing: garden at Castle Bar, A. Belt, 1888.

Hammersmith: Brook Green (Webb, J. of Mal., July 1897, p. 26); plentiful in gardens (J. McIntosh, Nat., 1853); railway bank, Oct. 1888! H. Wallis Kew.

West Kensington: in gardens (Webb, J. of Mal., July 1897, p. 26).

Kensington: not rare in forcing-houses and kitchen-gardens of Kensington Palace; also at Notting Hill terrace (J. Denson, Loudon's Magazine, 1833).

Essex S.—Fairly abundant in old garden, Wanstead (W. Crouch, Essex Nat., Oct. 1890, p. 209). Buckhurst Hill, W. Cole (Webb, J. of Mal., July 1897, p. 26).

Oxon—Middleton Park, Bicester, T. Trollope (Webb, J. of Mal., Dec. 1897, p. 49).

ANGLIA.

Norfolk E.—Ipswich road, by Mackie's Nursery Gardens, Norwich, J. Reeve, 1880! (Churchill Babington's collection). Abundant at Foulsham, Oct. 1884! Rev. J. W. Horsley.

Norfolk W.—King's Lynn, Miss Peckover (Churchill Babington's collection).

SEVERN.

Gloucester W.—Gardens, Clifton, T. G. Ponton, 1862 (Leipner's Bristol list, 1875, p. 281).

TRENT.

Lincoln S.—High Park Gardens, Stamford, D. Metcalfe (Webb, J. of Mal., July 1897, p. 26).

Leicester—Bean Manor Park, Loughborough, A. Hamshere (Webb, J. of Mal., Dec. 1897, p. 49). Belvoir Castle Gardens, Jan. 1888! W. Ingram.

Notts.—Welbeck Abbey, R. A. Rolfe! (C. T. Musson, 1884).

Derby—Little Eaton, Nov. 1897! J. Hill.

MERSEY.

Cheshire—Fairly numerous, Hoole, Nov. 1883, J. T. Riches. Rare in Upton lanes, and in some grassy lanes near nursery gardens, Chester, 1886! G. W. Shrubsole. Mr. Broome's Garden, Sale, Oct. 1890! T. Rogers. Dickson's Nurseries, Newton, near Chester, on rockwork, T. Ruddy, March 1887.

Lancashire S.—Gardens, Cuerden Hall, Preston, Jan. 1893! W. H. Heathcote.

HUMBER.

York S.E.—Woodleigh, Hessle, F. Mason (Webb, J. of Mal., July 1897, p. 26).

York N.E.—Abundant at Castle Howard, J. Riddell, and in Walshaw and Son's Nurseries, Scarborough (Webb, J. of Mal., July 1897, p. 26). Tunnel in Beeforth's Garden, Esplanade, Scarborough, Feb. 1899 ! J. E. Hargreaves.

York S.W.—Garden, Horbury, April 1891 ! W. Rushforth.

York Mid W.—Gledstone Hall, Skipton, J. Jopkinson (Webb, J. of Mal., July 1897, p. 26). Dr. Eddison's Garden, Adel, near Leeds, Nov. 1896 ! H. Crowther. Common after continued wet, Hyde Park road, Leeds, Nov. 1, 1900 ! Oliver Marsden. Garden, North lane, Headingley, Nov. 1886 ! E. R. Waite. Padman's Nurseries, Boston Spa, J. Emmet, July 1877.

TYNE.

Durham—Bensham Hall, near Gateshead, Jan. 1884 ! R. Y. Green. Gateshead and Axwell Park, near Newcastle, R. Howse, Nov. 1884.

SCOTLAND. *WEST LOWLANDS.*

Renfrew—Common, Rosebank Nurseries, Johnstone, Oct. 1898 ! S. M. Wellwood. Garden, Gartland place, near Paisley, April 1887 ; Kilnside Gardens, near Paisley, Feb. 1889 (J. M. B. Taylor, J. of Conch., 1889, vi., p. 115).

EAST HIGHLANDS.

Stirling—Peach-house of R. Smith, Brenthem Park, June 1895 ! G. McDougall.

Fife and Kinross—St. Brycedale Nurseries, Kirkcaldy, Oct. 1884 ! where it has been known for the past forty years, W. D. Sang.

IRELAND. *LEINSTER.*

Louth—Garden, Piperstown, near Drogheda, Feb. 26, 1890 ! Miss Sidney Smith.

Dublin—Trinity College Botanic Gardens, March 1891, W. F. Burbridge ! (R. F. Scharff). W. F. de Vismes Kane's Garden, Kingston (Scharff, Irish Nat., July 1893).

MUNSTER.

Waterford—Waterford, Mr. Garnett, jr. (Scharff, Irish Nat., July 1892).

Cork N.—Youghal, 1835, Warren Collection, Dublin Museum !

FRANCE.

Recorded as *T. bisulcata* from Provence, Languedoc, and Gascony, and in the

Alpes Maritimes—In gardens, Grasse, and the hills about Nice (G. & F., op. cit.).

Finistère—With *T. haliotidea*, Landerneau and Brest (Bourg., Mal. Bret., 1860).

Loire, Haute—Hills of Chosson, plain of Rome (Pascal, 1873, p. 23).

Morbihan—Common in gardens and cultivated fields, especially cabbage fields, about Vannes, Arradon, Auray, and upon the Ile d' Arz (Bourg., Mal. Bret., 1860).

Seine—In disused quarries, Les Moulineaux ; gardens, Grande Montrouge and Bourg-la-Reine ; environs of Orsay and St. Maur-les-Fosses, etc. (Pascal, 1873, p. 23).

Var—Not rare, Mouton (Moq.-Tand., Hist. Moll., 1855, ii., p. 41).

Vendée—(Massot, Mon. Test., 1870, p. 156).

As *Testacella scutulum* it has been recorded from the departments of the

Creuze—De Cessac (G. & F., op. cit., p. 54).

Gironde—La Teich, Facture, Sallas, etc. (Gassies, Mal. Aquitaine, 1876).

AUSTRO-HUNGARY.

Trieste, as *T. haliotidea*, Simroth, Nacktsch. Portug.-Azor., 1891.

ITALY.

As *T. bisulcata* it is recorded for Piedmont, the environs of Florence, Rome, Naples, etc. (Bourg., Rev. et Mag. Zool., Dec. 1881, p. 60). From Torrita, Masso di Sassorosso, and Bagni di Lucca in Tuscany (Stefani, Bull. Soc. Mal. Ital., 1875), and from Civitavecchia (Statuti, Bull. Soc. Mal. Ital., 1882, viii., p 15).

SPAIN.

Recorded as *T. bisulcata* from Valencia (Hidalgo, Hojas Mal., 1871, p. 27), and as *T. scutulum* from Granada, 1887 ! R. D. Darbishire (J. of Conch., 1888, v., p. 346).

CORSICA.

Ajaccio, as *T. scutulum* (Scharff, Reise Corsica, 1894, p. 160).

SARDINIA.

As *T. gestroi* recorded from S. Vito, where it was found by Dr. Gestro (Issel), and at Monte Santo di Paulo, near Cagliari ; Parco di Laconi ; forest of Monte Cresia, and in the Valley of Tarquisara (Paulucci, Bull. Soc. Mal. Ital., 1882).

NORTH AFRICA.

Algeria—Great Kabylie, as *T. haliotidea* (Kobelt, Zoogeogr., 1898). As *T. bisulcata* and *T. fischeriana* from environs of Alger (Lallemant, Moll. Alger, 1881) ; and as *T. bisulcata* from Tlemcen, near the Cascade of the Sefsef, Letourneux (Bourg., Alger, 1864, ii., p. 303), and Bona and Constantine (Bourg., Rev. et Mag. Zool., 1861).

Morocco—Cap Spartel, Grasset (Morelet, J. de Conch., 1880, p. 17).

Distribution of *T. scutulum* Sow.

In the Counties and Vice-Counties of the British Isles.

ENGLAND AND WALES.

Channel Isles

PENINSULA
1 Cornwall W.
2 Cornwall E.
3 Devon S.
4 Devon N.
5 Somerset S.
6 Somerset N.

CHANNEL
7 Wilts N.
8 Wilts S.
9 Dorset
10 Isle of Wight
11 Hants S.
12 Hants N.
13 Sussex W.
14 Sussex E.

THAMES
15 Kent E.
16 Kent W.
17 Surrey
18 Essex S.
19 Essex N.
20 Herts.
21 Middlesex
22 Berks.
23 Oxford
24 Bucks.

ANGLIA
25 Suffolk E.
26 Suffolk W.
27 Norfolk E.
28 Norfolk W.
29 Cambridge
30 Bedford
31 Hunts.
32 Northampton

SEVERN
33 Gloucester E.
34 Gloucester W.
35 Monmouth
36 Hereford
37 Worcester
38 Warwick
39 Stafford
40 Salop

SOUTH WALES
41 Glamorgan
42 Brecon
43 Radnor
44 Carmarthen
45 Pembroke
46 Cardigan

NORTH WALES
47 Montgomery
48 Merioneth
49 Carnarvon
50 Denbigh
51 Flint
52 Anglesey

TRENT
53 Lincoln S.
54 Lincoln N.
55 Leic. & Rutld.
56 Notts.
57 Derby

MERSEY
58 Cheshire
59 Lancashire S.
60 Lancashire Mid

HUMBER
61 S.E. York
62 N.E. York
63 S.W. York
64 Mid W. York
65 N.W. York

TYNE
66 Durham
67 Northumb. S.
68 Cheviotland

LAKES
69 Westmorland and L. Lancs.
70 Cumberland
71 Isle of Man

SCOTLAND.

W. LOWLANDS
72 Dumfries
73 Kirkcudbright
74 Wigtown
75 Ayr
76 Renfrew
77 Lanark

E. LOWLANDS
78 Peebles
79 Selkirk
80 Roxburgh
81 Berwick
82 Haddington
83 Edinburgh
84 Linlithgow

E. HIGHLANDS
85 Fife & Kinross
86 Stirling
87 Perth S. & Clkn
88 Mid Perth
89 Perth N.
90 Forfar
91 Kincardine
92 Aberdeen S.

E. HIGHLANDS
93 Aberdeen N.
94 Banff
95 Elgin
96 Easterness

W. HIGHLANDS
97 Westerness
98 Main Argyle
99 Dumbarton
100 Clyde Isles
101 Cantire
102 Ebudes S.
103 Ebudes Mid
104 Ebudes N.

N. HIGHLANDS
105 Ross W
106 Ross E.
107 Sutherland E.
108 Sutherland W.
109 Caithness

NORTH ISLES
110 Hebrides
111 Orkneys
112 Shetlands

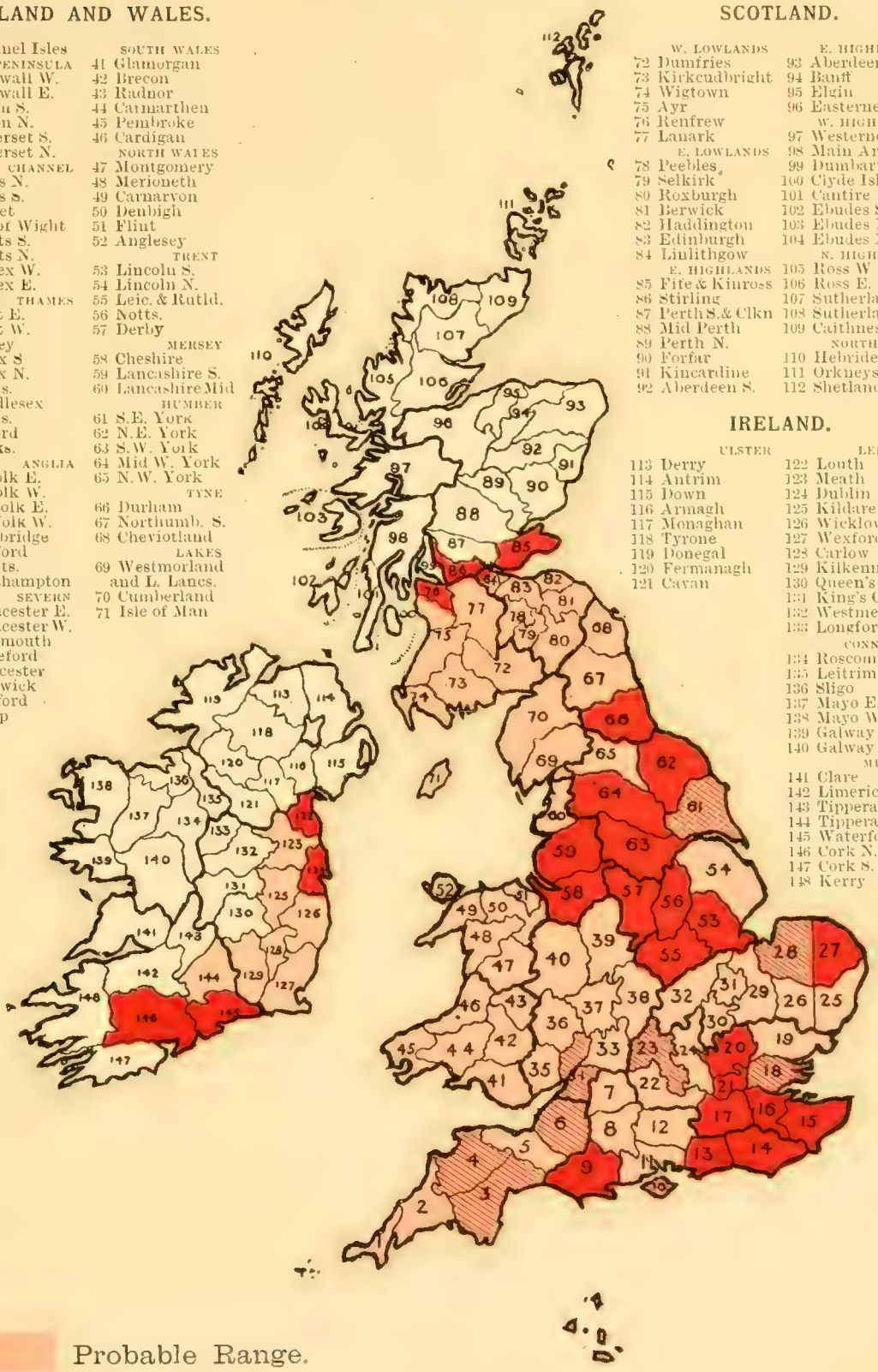
IRELAND.

ULSTER
113 Derry
114 Antrim
115 Down
116 Armagh
117 Monaghan
118 Tyrone
119 Donegal
120 Fermanagh
121 Cavan

LEINSTER
122 Louth
123 Meath
124 Dublin
125 Kildare
126 Wicklow
127 Wexford
128 Carlow
129 Kilkenny
130 Queen's Co
131 King's Co.
132 Westmeath
133 Longford

CONNAUGHT
134 Roscommon
135 Leitrim
136 Sligo
137 Mayo E.
138 Mayo W.
139 Galway W.
140 Galway E.

MUNSTER
141 Clare
142 Limerick
143 Tipperary N.
144 Tipperary S
145 Waterford
146 Cork N.
147 Cork S.
148 Kerry



Probable Range.

Recorded Distribution.

Distribution verified by the Authors.

Testacella maugei Férussac.

1801 **Testacella** *haliotoides* Lam., Sys. An. s. Ver., p. 96 (*nomen nudum*).
1805 — *haliotidea* pars, Drap., Hist. Nat. Moll. France, pl. 8, ff. 46-48.
1819 — **maugei** Fér., Hist. Moll., p. 94, pl. 8, ff. 10-12 ; Reeve, Brit. Moll., 1863, p. 32 and ff. ; Adams, Coll. Manual, 1896, p. 41, pl. 2, f. 3.
1827 — *asininum* de Serres, Ann. Sc. Nat., p. 409.
1850 — *lartetii* Dupuy, J. de Conch., i., pp. 302-4, pl. 15, ff. 2 a—d.
1851 — *bruntoniana* de Serres, Mem. Terr. Transp., p. 51.
1855 — *haliotidea* v. *scutulum* Moq.-Tand., Hist. Moll. France, pl. 5, ff. 20, 21.
1855 — *burdigalensis*, Gassies, Grateloup's Dist. Geog. Limaciens, p. 15.
1855 — *occanica* Grateloup, Dist. Geog. Limaciens, p. 15.
1855 — *aquitanica* Grateloup, Dist. Geog. Limaciens, p. 16.
1855 — *browniana* Grateloup, Dist. Geog. Limaciens, p. 16.
1855 — *occitaniæ* Grateloup, Dist. Geog. Limaciens, p. 16.
1855 — *monspessulana* Grateloup, Dist. Geog. Limaciens, p. 16.
1855 — *canariensis* Grateloup, Dist. Geog. Limaciens, p. 16.
1855 — *altæ-ripæ* Grateloup, Dist. Geog. Limaciens, p. 16.
1855 — *deshayesii* Michaud, Desc. Coq. Foss., p. 3, pl. 2, ff. 10, 11.
1881 — *nouleti* Bourg., Hist. Mal. Colline de Sansan, p. 15.
1819 *Plectrophorus orbignyi* Fér., t. Simroth, Nacktschnecken Portug.-Azorischen, 1891, p. 404.

History.—*Testacella maugei* was discovered at Teneriffe in 1796 by M. Maugé, in whose honour it was named by Férussac, and according to Dr. Turton, was said to have been first found in England by Mrs. Smith, in her garden at Bristol ; in 1812 Mr. T. Drummond detected it in Miller and Sweet's (now Garaway's), Durdham Down Nurseries at Clifton, Bristol, and sent specimens to Dr. Leach, which were forwarded to and figured by Férussac.

Although a very distinct species it is far from being accurately known, and from the earliest period has been and is still often confused with *T. haliotidea* by otherwise competent conchologists. M. Draparnaud figured undoubted *T. maugei* as the adult form of *T. haliotidea*, while Moquin-Tandon also figures what is probably the present species as *T. haliotidea* v. *scutulum*.

Gassies and Fischer, the able monographers of the genus, in their great work, "Monographie du genre Testacelle" (pl. i., f. 15) illustrate the reproductive organs of *T. haliotidea*, but erroneously ascribe them to the present species ; this unfortunate confusion was accepted and endorsed in some of their writings by the famous limacologists, Simroth and Pollonera, and to add to these regrettable mistakes, the brilliant French biologist, Prof. Lacaze-Duthiers, has in his otherwise masterly work, " Histoire de la Testacelle," perpetuated further misapprehension of the organization of this species, with which he was evidently unacquainted.

The organization of *T. maugei* is of a simpler and more primitive type than that of its congeners, and its more marked restriction to the confines of Western Europe confirms this species as being the most ancient form of our *Testacellæ*.

Diagnosis.—Externally, *T. maugei* is readily recognisable by its large, convex, and semi-cylindrical shell, and by the lateral grooves upon the body of the animal being so wide apart at their origin at the peripallial furrow.

Internally, the distinctive features are even more striking, the lingual sheath being quite deficient of lateral muscles and possessing only terminal retractors, while the right and left tentacular retractors are both affixed to the integument quite on the left side of the animal; the penis sheath differs from that of *T. scutulum* in its strikingly clavate shape, and from *T. haliotidea* in the absence of the flagellum which is so marked a feature in that species.

Description.—ANIMAL elongate, attenuate anteriorly and very tumid towards the rear; 60-100 mill. in length when fully extended, but very short and cylindrical when contracted; GROUND-COLOUR greyish-white to black, but usually of an earthy-brown, paler laterally and besprinkled with deep-brown specks, which are most plentiful on the back; the longitudinal dorsal furrows are well defined and enclose a double row of conspicuous tubercles; LATERAL FURROWS deeply incised and much wider apart at their origin at the peripallial furrow than in the allied species; MANTLE sparingly maculate, and sometimes partially enveloping the shell; SOLE similarly but more brightly colored than the body, whitish, yellow, pink, or even black, FOOT-FRINGE sometimes marked with perpendicular lineoles, as in *Arion*; SLIME colorless and not very tenacious.

SHELL subquadrately oblong, very convex, compressed or slightly sinuate at front margin, and about one-sixth of the total length of the animal when extended, whitish with a brown periostracum which becomes abraded from all the more exposed parts of the shell; SPIRE produced and terminal, consisting of about 1¼ whorls; LINES OF GROWTH variable but often strong and irregular; APERTURE oblong, very large, outer margins slightly expanded, interior slightly nacreous; COLUMELLA narrow, convex, and regularly arched. Length, 15 mill.; breadth, 7 mill.; alt., 4 mill.

INTERNALLY, the REPRODUCTIVE SYSTEM is simple in its organs and their arrangement, and characterized by a short PENIS-SHEATH, very narrow below, but abruptly swollen above, without a FLAGELLUM, but with a strong terminal RETRACTOR, which is attached dorsally to the outer integument towards the rear of the body; the VAGINA is much shorter than in *T. scutulum*, and considerably less dilated above; OVOTESTIS greyish or yellowish-white, composed of loose oblong follicles imbedded within the digestive gland and difficult to isolate; HERMAPHRODITE DUCT very tortuous and entering the albumen gland very high up; ALBUMEN GLAND enormous, linguiform, of a yellowish or ochreous tint; OVIDUCT clear bluish-white, with broad ample folds; SPERM-DUCT opaque, buff or cream-coloured; VAS DEFERENS stiffly convoluted at its origin from sperm-duct, and entering the penis-sheath at the free end, close to the retractor muscle; SPERMATHECA globular or roundly-oval, clear grey, marked superficially with white vein-like markings, and imbedded in the base of the albumen gland, to which it has muscular attachment; SPERMATHECA DUCT long, about three times the diameter of vesicle, thickened at base and longitudinally striped, the upper half adherent to oviduct, the lower half sometimes attached to vagina by a stout muscle; ATRIUM short.

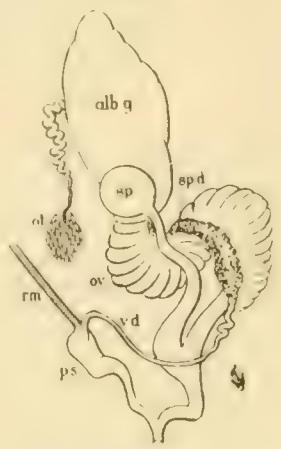


FIG. 32.—Sexual organs of *Testacella maugei* ×1½. (Bristol, Mr. J.W. Cundall). *alb.g.* albumen gland; *ot.* ovotestis; *ov.* oviduct; *p.s.* penis sheath; *r.m.* retractor muscle; *sp.* spermatheca; *sp.d.* sperm duct; *v.d.* vas deferens.

The ALIMENTARY CANAL with short ŒSOPHAGUS, opening out into a broadly oval or pyriform CROP, which is whitish when empty, and has thick walls especially towards the pyloric end, with the whole surface corrugated with longitudinal and transverse wrinkles, and attached to left side of body by a sheet of muscles; the vestigial STOMACH, a small, white, rounded protuberance, is at first bend of gut, at the point where the intestine enters the digestive gland and receives the thick white bile ducts; the DIGESTIVE GLAND is brownish buff, speckled or reticulated with white; INTESTINE very stout in its early course.

The TENTACULAR RETRACTORS of *T. maugei* are especially remarkable for their curious asymmetry and inequality; the left retractor is affixed to the body-wall of the left side, close to the margin of the foot-sole, while the noticeably longer right tentacular muscle is attached to the sole also quite to the left of the median line of the body.

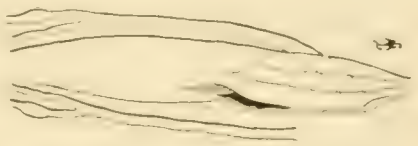


FIG. 33.—Lingual sheath of *Testacella maugei*, illustrating the retractor muscles of the tentacles and lingual sheath.

The LINGUAL SHEATH presents the same pearly-white glistening appearance which characterizes that of the preceding species, but it is comparatively smaller and its retractors more simple, consisting of two to five pairs of partially-independent and powerful terminal muscles, any one of which exceeds in mass the cephalic retractor of *Arion ater* or *Limax maximus*, all with common point of fixation to the integument on the left side of the body beneath the shell. The lateral muscles so conspicuous in *T. haliotidea* and *T. scutulum* are quite absent.

The LINGUAL TEETH in this species are more closely arranged upon the radula, and the transverse rows of teeth much less acutely angulated than in either *T.*

FIG. 34.—Transverse row of teeth from odontophore of *T. maugei* × 20, from Bristol; figured from a photo. by A. H. Cooke.

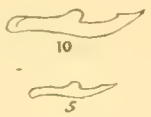


FIG. 35.—Isolated teeth from the fifth and tenth longitudinal rows of the radula of *T. maugei* × 40.

haliotidea or *T. scutulum*,[1] the individual teeth are smaller, less distinctly barbed, the poaphysis near the middle of the tooth, and the minute vestigial central tooth distinctly perceptible in certain parts of the radula.

The dental formula of a Bristol specimen is $\frac{14+0+1+0+14}{1\quad\quad 1\quad\quad 1} \times 30 = 870$

Reproduction and Development.—According to Gassies, it is the most prolific species of the genus, and in France may lay five times in one year, eight to fifteen large, somewhat acuminate oval eggs, about five mill. by four mill., which are enclosed in firm, white calcareous shells, which gradually become yellowish. In this country they have been observed to lay in May and August, the eggs hatching in from twenty to thirty-five days, according to the weather.

FIG. 36.—Egg of *T. maugei* × 1½ (after Gassies and Fischer).

Food and Habits.—*T. maugei* is not active, but more gregarious than either *T. haliotidea* or *T. scutulum*, and is also more insatiable and ravenous, destroying its congeners in default of other food when confined with them. It usually lives from six to twelve inches beneath the surface, its retreat, according to Mr. Tomlin, being easily detected by the large, clean-cut hole it leaves, very different from that of a worm, and usually beneath some sheltering plant.

In wet weather, when driven from their subterranean retreats, they hide beneath the foliage of garden pinks or other sheltering plants, often in a sort of open nest in the moist earth, to the aspect of which their usual colouring closely assimilates.

Geological History.—*Testacella maugei* has not been found fossilized in this country, but has been recorded from the basin of the Rhone, and has been described under the names of *T. lartetii* Dupuy, *T. nouleti* Bourg.,

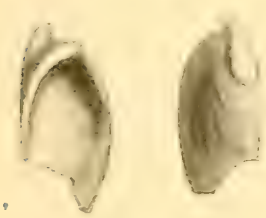


FIG. 37.—*T. lartetii* × 3 (after Gassies & Fischer).

FIG. 38.—*T. lartetii* × 4 (after Dupuy).

FIG. 39.—*T. nouleti* Bourg. × 2 (after Gassies & Fischer).

and *T. aquitanica* Grateloup, from a friable, argillaceous marl in the hill of Sansan, Gers, ascribed to Miocene age. The *T. deshayesii* Michaud and *T. alta-ripa* Grateloup, from the blue Pliocene marls of Haute-Rive in the Drôme, are also considered practically identical with *T. maugei* by Gassies and Fischer, while *T. asinina* de Serres, from the Middle Pliocene freshwater deposits of Frontignan, near Cette, and *T. bruntoniana* de Serres, from the

1 This peculiarity alone establishes the incorrectness of the reference to *T. haliotidea* of the figure of the teeth, given on p. 298 of Woodward's Manual; it should be really ascribed to the present species, Mr. Cocken, who prepared the radula from which the engraving was made, correctly indicated the species under Lamarck's name, *T. haliotoides*.

whitish Middle Pliocene marls of Celleneuve, near Montpellier, may also be referred to the same species.

According to M. Paul Fischer, all the tertiary *Testacellæ* belong to the *maugei* group, and in common with other mollusca now restricted to western regions had formerly a more extended eastern range.

Variation.—Although the anatomical details of British specimens show a structure in consistent agreement with the various figures I give, yet some authors show certain modifications in the shape of various organs which they affirm to exist in the specimens examined by them.

Externally, no differences in the shell of *T. maugei* have been chronicled or named by authors, but I have established a var. *aperta* for the reception of the broad Azorean examples and reduced the *Testacella asinina* de Serres to the rank of a variety.

Wide variation has, however, been observed in the colour of the body. Gassies and Fischer discriminated six different forms, two of them—var. *roseo-fulvescens*, somewhat rare, and var. *griseo-fulvescens*—without any figure or description, except such indication as their descriptive names imply.

In the present work eight varieties are accepted, and two, var. *aurea* and var. *aperta*, are described for the first time.

VARIATIONS IN FORM OF SHELL.

Var. **aperta** Taylor.

Shell comparatively wider and flatter or less convex than type; aperture consequently more open and ovate. Length, 14 mill.; diam., 8 mill.; alt., 3 mill.

Azores—Arthur Morelet (R. D. Darbishire, 1901 !)

Var. **asinina** de Serres, Ann. Sc. Nat., p. 409, 1827.

Testacella asininum de Serres, Ann. Sci. Nat., 1827, p. 109.
Testacella monspessulana Grat., Geog. Limac., p. 16, 1855.

Shell elongate and markedly narrower than type, more especially anteriorly. Length, 13 mill.; breadth, 5 mill.

This variety has hitherto only been found in the fossil state, in the Middle Pliocene freshwater deposits at Frontignan near Cette, in the Hérault, but only imperfect specimens have as yet been discovered, and these cannot be entirely freed from the rock in which they are imbedded (Gass. & Fischer, Mon. Test., 1856, p. 42).

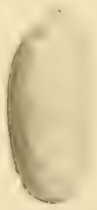


Fig. 10. — *Testacella asinina* de Serres, × 1½ (after Gassies & Fischer).

VARIATIONS IN COLOUR OF ANIMAL.

Var. **albina** Gassies & Fischer, Monog. Testacelle, 1856, pp. 38, 39.

Body and sole approaching old ivory in colour with a fawn-coloured dorsal band.

According to Gassies and Fischer, this variety is characterized by its voracity.

France—(Gassies & Fischer, op. cit.).

Var. **griseo-nigrescens** Gassies & Fischer, Monog. Testacelle, 1856, p. 36.

Body smoky-grey, sides whitish speckled with black, foot-fringe very pale yellow.

This variety, which resembles *Agriolimax agrestis* in its general facies and colouring, is the common form in the Gironde (Monog. Testacelle, 1856, p. 36).

Pembrokeshire—Near Pembroke, June 1885 ! Mrs. Trayler.

France—Common at Gradignan and Blanquefort in the Gironde (Gassies, 1876).

Var. **viridans** Gassies & Fischer, Monog. Testacelle, 1856, p. 38.

Body greenish-brown, analogous to bronze, ventral disc very lively orange-red.

According to Morelet, this is the ordinary Portuguese form, and would appear to constitute another age-link, joining South Ireland with the Iberian peninsula.

Waterford—Nursery garden, Waterford, Sept. 1883 ! J. H. Salter.

Portugal—Common from the parallel of Coimbra to the shores of Algarve (Morelet, Moll. Port., 1845, p. 18).

Var. **griseo-rubescens** Gassies & Fischer, Monog. Testacelle, 1856, p. 38.

Body rufous, maculated with brown, sole-fringe orange-red.

This is the form figured by Férussac from Bristol specimens sent by Dr. Leach.

Dorset—Rectory Gardens, Corfe Castle, Nov. 1885 ! Eustace Bankes.

Gloucester W.—Bristol, J. W. Cundall, Nov. 1883.

France—(Gassies & Fischer, op. cit.).

Var. **aurea** Taylor.

Body and foot bright yellow, besprinkled with black dots, chiefly on back.
Gloucester W.—Gardens, Cotham near Bristol, 1883 ! Miss F. M. Hele.
Glamorgan—Cardiff, F. W. Wotton, Jan. 1889.

Var. **nigra** Collinge, Journ. of Conch., 1898, p. 95.
Pembrokeshire—Tenby, 1892 (Mus. Zool. Cambridge University).

Geographical Distribution.—*T. maugei* is distinctly and pre-eminently a western and retreating species, now restricted to the western coast regions of Europe, Africa and adjacent islands of the Palæarctic region, although it may still linger in a few isolated places comparatively remote from the geographical area chiefly occupied at the present day. It has been recorded from the British Isles, France, Spain, Portugal, Morocco, Azores, Canaries, and Madeira.

It has also been reported from greenhouses in Philadelphia, U.S.A., in the Nearctic region; as *T. auriyaster* from the Cape, in the Ethiopian region; and as *T. vagans* from Auckland, New Zealand, in the Australasian region.

In the British Isles it is also strictly south-western in its range, and has been recorded from various localities in the South and West of England, South Wales and the South of Ireland.

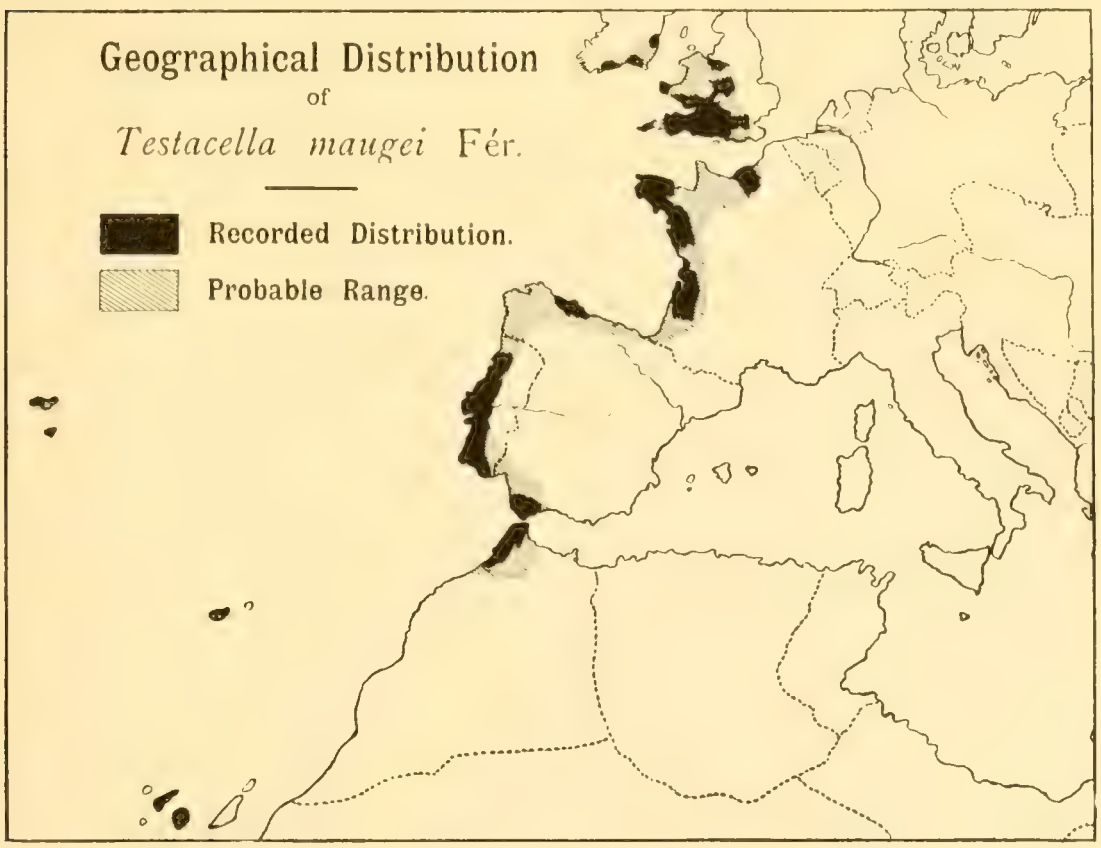


Fig. 11.

ENGLAND AND WALES.

Channel Isles—Bank at foot of garden wall, St. Saviour's road, St. Helier's, Jersey, and in a garden about half-a-mile distant (Bull, Sci. Goss., July 1878, p. 161).

PENINSULA.

Cornwall W.—Phillack rectory grounds, 1878 ! Miss Hockin. Common, Paul Church Town, near Penzance, May 1886 ! W. E. Baily. Falmouth, Sept. 1887 ! J. H. James. Truro, Aug. 1888 ! J. H. James. Treherne Probus, near Truro, Capt. Pinwell (Webb, J. of Mal., July 1897, p. 26).

Devon S.—Garden, Park street, Exeter (J. C. Bellamy, Nat. Hist. S. Devon, 1839, p. 246). Veitch's Nursery, Exeter (E. Parfitt, Nat., 1854, p. 150). Plymouth (Jeffr., Brit. Conch., 1862, i., p. 147).

Devon N.—Riccard's Down, Abbotsham, Bideford, Oct. 1896! C. R. C. Hibbert.

Somerset S.—Abundant, Sunnyside, Bridgewater, April 1890! H. Corder. Frequent in Taunton Nursery Gardens (J. McIntosh, Nat., 1853, p. 180).

Somerset N.—Bath, Brislington, and in Sir Arthur Elton's gardens at Clevedon, (Norman, Inland Moll. Somerset, 1861, p. 139). In W. S. Clark's garden, Street, and abundant at Grenton (Nat. Hist. Journ., 1878. p. 134). Garden, near Axbridge, July 1884! Miss H. J. Taylor. Plentiful in garden of Long Ashton Vicarage, Nov. 1889! Mrs. Falloon. Castle Cary, April 1887! W. Macmillan.

Wilts S.—Fields near Devizes, Mr. Cunnington (Woodward's Manual, 1875, p. 298). Longleat Gardens, Warminster, J. Trollope (Webb, J. of Mal., Dec. 1897, p. 49).

CHANNEL.

Dorset—Gardens, Down House, Blandford, J. C. Mansel-Pleydell, 1885! This specimen was recorded as *T. haliotidea*, in the Trans. Dorset Soc., for 1885, and elsewhere, by Mr. Mansel-Pleydell. Rectory Gardens, Corfe Castle, Nov. 1885! Eustace Bankes.

Hants S.—Fareham, J. W. Cundall, 1885. Porchester, A. G. Headley (Webb, J. of Mal., July 1897, p. 26).

Hants N.—Andover, E. J. Lowe, Dec. 1887.

THAMES.

Surrey—Leatherhead, E. Step (Pannell, Journ. of Conch., 1902, p. 170).

Middlesex—One specimen in the British Museum, labelled as found in "Kensington Gardens"! Several in Bean's Collection, Scarborough Museum, labelled "*T. haliotidea*, near London"!

Berks.—Specimens in the collections of the late Thos. Rogers and J. R. Hardy, said to be from Faringdon!

Notts.—Erroneously recorded for Welbeck Abbey by C. T. Musson (Mid. Nat., 1878, p. 309).

SEVERN.

Worcester—Glenthorn and Boughton, near Worcester, G. Reece, Nov. 1883. Redditch, G. S. Tye, March 1886. Nursery grounds, near Worcester, June 1897! (Collinge, J. of Mal., Dec. 1897, p. 63).

Warwick—Gardens, Edgbaston near Birmingham, May 1897! (Collinge, J. of Mal., Dec. 1897, p. 43).

Gloucester W.—Found in 1812 in Miller and Sweet's (now Garaway's) Nurseries at Clifton by Mr. Drummond, but the original site is now built over. Old Burial Ground, Lewins Mead Chapel, Bristol, P. P. Carpenter (R. D. Darbishire, Nov. 1883!) Hampton Park, common, A. Leipner; and Kingsdown, W. W. Stoddart (Leipner, Proc. Bristol Nat. Hist. Soc., 1875, p. 281). Gardens, Redland (J. W. Cundall, J. of Conch., 1882, p. 265). Gardens, Cotham (Poulton and Ord, 1877). Horfield, Nov. 1883! Miss F. M. Hele. Stoke Gifford, Bristol, G. Summers (Webb, J. of Mal., July 1897, p. 26).

Monmouth—Reported under the name of *T. haliotidea* as plentiful in Hangman's Wood, the gardens, Shirenewton Hall! and near Chepstow, also in cottage gardens and fields at and about Shirenewton village, abundant at Hardwick, Itton Court, St. Pierre, The Wylands and Mathem, near Chepstow, also in gardens at Chepstow, Portskewett, and Newport (E. J. Lowe, Report Brit. Assoc., 1883).

MERSEY.

Cheshire—Clibran's Nursery Gardens, Bowdon, April 1897! (Collinge, J. of Mal., Dec. 1897, p. 43).

SOUTH WALES.

Glamorgan—Bridgend, under leaves in a little wood, July 1885! C. G. Barrett. Common in gardens, Crockherbtown, also in Lord Bute's gardens in North road, and Lord Windsor's at St. Fagan's, all near Cardiff, F. W. Wotton, Jan. 1889. Windsor place, Cardiff, at bottom of carnation pots, A. Pike (Webb., J. of Mal., July 1897, p. 26. In the late Dr. Jeffreys' garden, Norton, near Swansea (Brit. Conch., i., p. 147, 1862).

Pembroke—Near Pembroke, June 1885! Mrs. Trayler. Deer Park Villas, Tenby, A. G. Stubbs (Webb, J. of Mal., Dec. 1897). Numerous in garden, Saundersfoot road, Tenby, and in a garden, Penally (Stubbs, J. of Conch., 1900, p. 322).

IRELAND. *LEINSTER.*

Dublin—Common in the Royal Botanic Gardens, Glasnevin, Dublin (Thompson, Ann. Nat. Hist., Sept. 1847, p. 174).

MUNSTER.

Waterford—Nursery garden, Waterford, Sept. 1883! J. H. Salter. Cappagh, 1892, R. G. Ussher! (R. F. Scharff).

Cork S.—Garden, Bandon, Prof. G. J. Allman (Thompson, Ann. Nat. Hist., Sept. 1847, p. 174).

Distribution of *Testacella maugei* Fer.

In the Counties and Vice-Counties of the British Isles.

ENGLAND AND WALES.

Channel Isles

PENINSULA
1 Cornwall W.
2 Cornwall E.
3 Devon S.
4 Devon N.
5 Somerset S.
6 Somerset N.

CHANNEL
7 Wilts N.
8 Wilts S.
9 Dorset
10 Isle of Wight
11 Hants S.
12 Hants N.
13 Sussex W.
14 Sussex E.

THAMES
15 Kent E.
16 Kent W.
17 Surrey
18 Essex S.
19 Essex N.
20 Herts.
21 Middlesex
22 Berks.
23 Oxford
24 Bucks.

ANGLIA
25 Suffolk E.
26 Suffolk W.
27 Norfolk E.
28 Norfolk W.
29 Cambridge
30 Bedford
31 Hunts.
32 Northampton

SEVERN
33 Gloucester E.
34 Gloucester W.
35 Monmouth
36 Hereford
37 Worcester
38 Warwick
39 Stafford
40 Salop

SOUTH WALES
41 Glamorgan
42 Brecon
43 Radnor
44 Carmarthen
45 Pembroke
46 Cardigan

NORTH WALES
47 Montgomery
48 Merioneth
49 Carnarvon
50 Denbigh
51 Flint
52 Anglesey

TRENT
53 Lincoln S.
54 Lincoln N.
55 Leic. & Rutld.
56 Notts.
57 Derby

MERSEY
58 Cheshire
59 Lancashire S.
60 Lancashire Mid

HUMBER
61 S.E. York
62 N.E. York
63 S.W. York
64 Mid W. York
65 N.W. York

TYNE
66 Durham
67 Northumb. S
68 Cheviotland

LAKES
69 Westmorland and L. Lancs.
70 Cumberland
71 Isle of Man

SCOTLAND.

W. LOWLANDS
72 Dumfries
73 Kirkcudbright
74 Wigtown
75 Ayr
76 Renfrew
77 Lanark

E. LOWLANDS
78 Peebles
79 Selkirk
80 Roxburgh
81 Berwick
82 Haddington
83 Edinburgh
84 Linlithgow

E. HIGHLANDS
85 Fife & Kinross
86 Stirling
87 Perth S. & Clkn
88 Mid Perth
89 Perth N.
90 Forfar
91 Kincardine
92 Aberdeen S.

E. HIGHLANDS
93 Aberdeen N.
94 Banff
95 Elgin
96 Easterness

W. HIGHLANDS
97 Westerness
98 Main Argyle
99 Dumbarton
100 Clyde Isles
101 Cantire
102 Ebudes S.
103 Ebudes Mid
104 Ebudes N.

N. HIGHLANDS
105 Ross W.
106 Ross E.
107 Sutherland E.
108 Sutherland W.
109 Caithness

NORTH ISLES
110 Hebrides
111 Orkneys
112 Shetlands

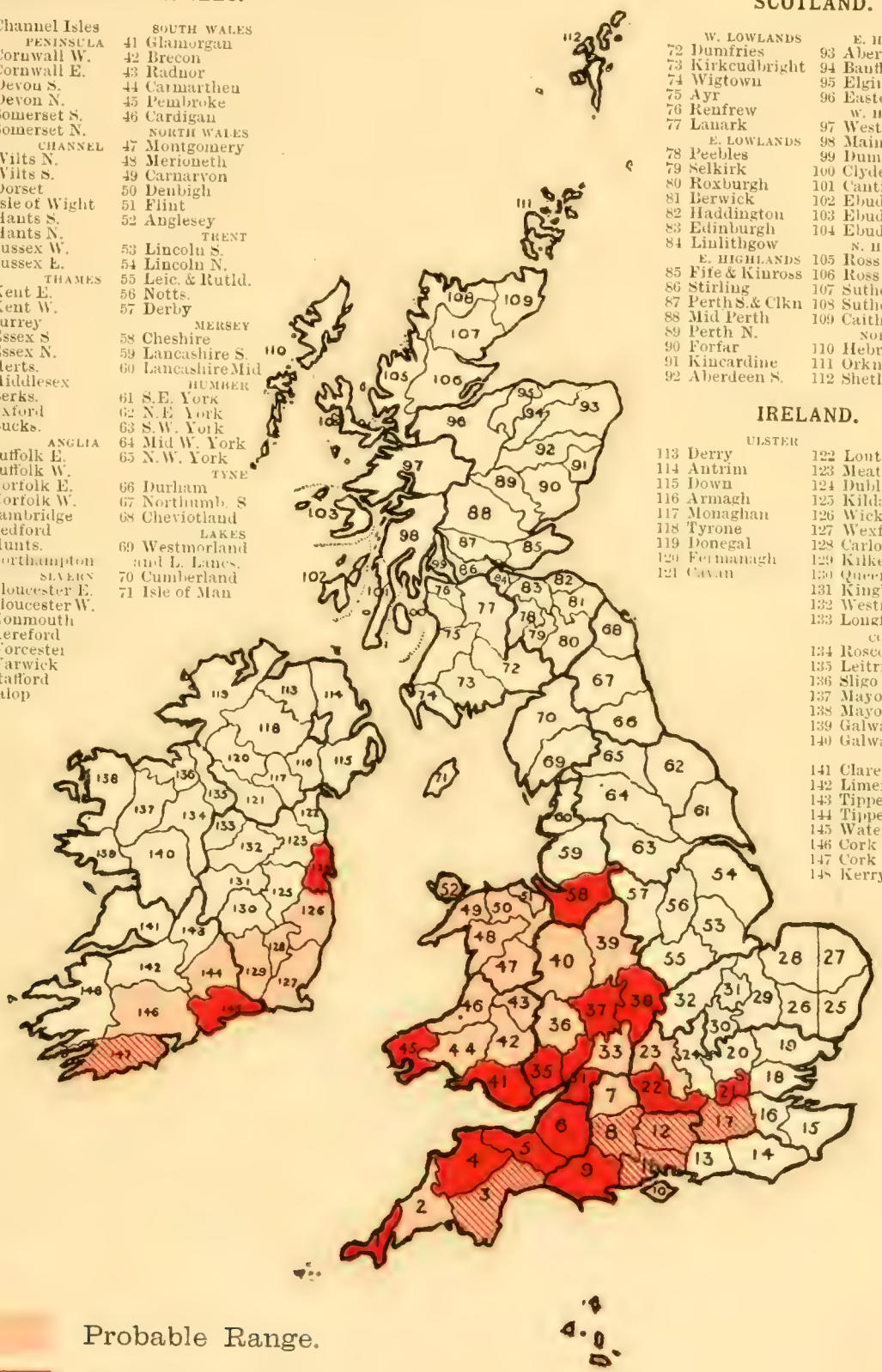
IRELAND.

ULSTER
113 Derry
114 Antrim
115 Down
116 Armagh
117 Monaghan
118 Tyrone
119 Donegal
120 Fermanagh
121 Cavan

LEINSTER
122 Louth
123 Meath
124 Dublin
125 Kildare
126 Wicklow
127 Wexford
128 Carlow
129 Kilkenny
130 Queen's Co.
131 King's Co.
132 Westmeath
133 Longford

CONNAUGHT
134 Roscommon
135 Leitrim
136 Sligo
137 Mayo E.
138 Mayo W.
139 Galway W.
140 Galway E.

MUNSTER
141 Clare
142 Limerick
143 Tipperary N.
144 Tipperary S.
145 Waterford
146 Cork N.
147 Cork S.
148 Kerry



Probable Range.

Recorded Distribution.

Distribution verified by the Authors.

FRANCE.

In several maritime departments bordering upon the Atlantic Ocean.

Charente-Inférieure—La Rochelle (G. & F., Mon. Test., 1856, p. 39).

Finistère—Common about Brest, also at Moulin Blanc, commune of St. Marc (Daniel, J. de Conch., 1883, p. 376).

Gironde—Bordeaux, Gradignan and Blanquefort (G. & F., 1856, op. cit., p. 39).

Loire-Inférieure—Cleons, near Nantes (Cailliaud, Cat. Moll. Loire-Inf., 1865, p. 206).

Morbihan—Parc de Roguédas, near Vannes (Bourg., Mal. Bret., 1860, p. 44).

Seine-Inférieure—Dieppe, Dugué (G. & F., 1856, op. cit., p. 39.)

SPAIN AND PORTUGAL.

Spain—Asturias (P. Fischer, Man. de Conch., 1883, p. 202). Algeciras in Andalusia, 1889, J. H. Ponsonby !

Portugal—From the parallel of Coimbra as far as the shores of the Algarve (Morelet, Moll. Port., 1845, p. 18). Lisbon, March 1852, R. McAndrew. Algés, A. Nobre (Mal. Tage et Sado, 1886, p. 122). Oporto (Simroth, Nacktsch. Portug.-Azor., 1891, p. 210).

NORTH AFRICA.

Morocco—Among dead leaves in damp spot in garden and under similar conditions at foot of a wall in a deep ravine, Tangiers, J. H. Ponsonby ! These specimens were erroneously recorded as *T. bisulcata* by Herr Hesse (Mal. Blätt., 1885, p. 9).

ATLANTIC ISLES.

Azores—Cultivated grounds in S. Miguel, Sta. Maria and Fayal (Wollaston, Test. Atl., 1878, pp. 13, 14).

Canaries—Cultivated land in Teneriffe and Gran Canary. Rev. Dr. Watson also found it sub-fossilized at Tafira, Gran Canary (Wollaston, Test. Atl., 1878, p. 311).

Madeira—In cultivated grounds about Funchal ; at the Val, at S. Gonçalo, and Camara de Lobos ; in Dr. Rendall's garden at Val Quinta and near S. Martinho (Wollaston, Test. Atl., 1878, p. 73).

ETHIOPIAN REGION.

Cape Colony—Collected abundantly at Cape of Good Hope about 1857 by the late Mr. E. L. Layard !

NEARCTIC REGION.

United States—Greenhouse at Lower Roxburgh, Philadelphia, Pa. (Robert Walton, Nautilus, 1891, p. 83), also in greenhouse in School Lane, Germantown, Philadelphia (M. Schick, Nautilus, April, 1895, p. 133).

AUSTRALASIAN REGION.

New Zealand—Prof. Hutton has described a *Testacella* from gardens about Auckland, under the name of *vagans*, which Mr. Cheeseman, of the Auckland Museum, thinks may prove to be *maugei* (C. T. Musson, Proc. Linn. Soc. N. S. Wales, 1890, p. 885).

FIG. 42.—The classical locality for *Testacella maugei*,
Durdham Down Nurseries, Clifton, as they appeared half-a-century ago.

Genus *GLANDINA* Schumacher.

(Oleacina, Bolten; Polyphemus, Montfort; Cochlicopa pars, Férussac).

The genus *Glandina* (dim. of *glans*, a gland) is a primitive group of predacious snails of achatinoid origin preying chiefly upon the phytophagous species, but also devouring smaller individuals of their own kind. Although their head-quarters are now in the West Indies and Central America, where living forms are found scarcely separable from some of our Oligocene fossils, yet a single well-marked species, *Glandina algira*, still lingers in the Mediterranean region, the only surviving representative of the numerous European species whose remains are found in the Eocene and Miocene deposits of Continental Europe and the Oligocene beds of our own country; although two of the British forms are possibly erroneously referred to the present genus, I have not had the opportunity to make a personal examination of the specimens.

Externally, *Glandina* is characterized by an elongate, anteriorly attenuate body; long ommatophores, with the eyes behind their deflected tips; bulbous anterior tentacles; elongate and extensile labial palps; narrow foot. The shell is long and fusiform, of a lustrous white or horn colour; whorls six to eight; columella twisted and basally truncate; aperture narrow, peristome simple.

Internally, they are destitute of the mandible; the lingual sheath is enormous, and the radula furnished with obliquely arcuate posteriorly converging rows of Acanthoglossate[1] teeth, with a slender unicuspid median row.

Glandina costellata (Sowerby).

1823 *Bulimus* **costellatus** Sow., Min. Conch., iv., p. 89 bis, pl. 336.
1829 *Limnæa maxima* Sow., Min. Conch., vi., p. 53, pl. 528, f. 1.
1852 *Achatina costellata* F. E. Edwards, Mon. Eoc. Moll., p. 75, pl. 7, f. 1a–k.
1891 **Glandina** *costellata* R. B. Newton, Syst. List Edwards' Coll., p. 276.

Shell oval-oblong, with a somewhat acute apex; whorls six, somewhat convex and transversely ribbed, the ribs being rounded, irregular, rather oblique and thickened at the sutures, giving them a crenulate aspect; growth lines obscure, intersecting the obliquely longitudinal ribbing; aperture narrow and pyriform, length, 32 mill.

Length of shell, 60 mill.; diam., 22 mill.

The existing species, *G. lignaria* Reeve, from Mexico, and *G. conspersa* Pfr., from Guatemala, resemble this species so closely that Starkie Gardner considers it difficult to avoid uniting them.

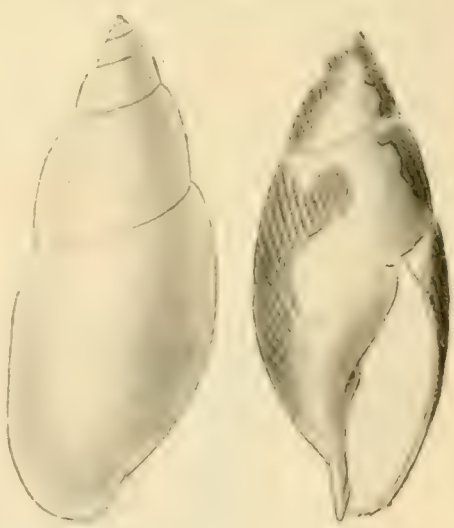


Fig. 13. Fig. 14.
Glandina costellata (Sow.).
(After Edwards). Slightly reduced.

ENGLAND AND WALES.

Oligocene.[2]—This species is mostly found in the Bembridge limestone strata, but usually in the form of casts, the shell being rarely preserved.

ISLE OF WIGHT.

Headon Series.—J. S. Gardner, Geol. Mag., 1885, p. 247.

Osborne Series.—C. Ashford, 1888.

Bembridge Series.—In a pit on north of road, Shalcombe (J. Sow., Min. Conch., 1823, p. 89 bis). Stone quarries, Binstead, near Ryde, Prof. Sedgwick, 1826 (Sow., Min. Conch., vi., p. 53, 1829). Sconce and Headon Hill (Edwards, l.c., p. 76). Bembridge, Hempstead, Whitecliff Bay, etc., C. Ashford, 1888.

1 Monog. i., p. 267, f. 533. 2 Monog. i, p. 411.

HANTS S.

BEMBRIDGE SERIES.—Hordwell, with Myæ, Psammobiæ, and Corbulæ (Gray's Turton, Brit. Shells, 1840, p. 43).

FRANCE.

Palæotherium limestone, Department Aude (J. S. Gardner, Geol. Mag., 1885, p. 247).

Var. **abbreviata** Edwards, Mon. Eoc. Moll., 1852, pl. 12, ff. i-k.

SHELL more ventricose than the typical form, with a shorter spire; WHORLS five, more convex, the last whorl constituting almost the whole of the shell; APERTURE longer in proportion than that of the type, and exceeding the spire in length, owing probably to the shell not having attained maturity.

Length of shell, 40 mill.; diam. 25 mill.

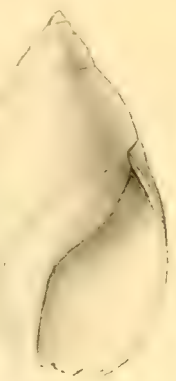


FIG. 45.
Var. *abbreviata* Eds., Sconce, Isle of Wight. (After Edwards). Slightly reduced.

ENGLAND AND WALES. *ISLE OF WIGHT.*

Oligocene—Bembridge limestone series at Sconce[1] (R. B. Newton, Syst. List Edwards' Coll., 1891, p. 276).

Glandina convexa (S. V. Wood).

1877 *Bulimus* **convexus** S. V. Wood, Eoc. Moll., iv., p. 335, pl. 34, f. 6.
1891 **Glandina** *convexa* R. B. Newton, Syst. List Edwards' Coll., p. 275.

SHELL elongate, turreted; WHORLS six, convex; SUTURE impressed; BASE convex; COLUMELLA subreflexed; UMBILICUS small; APERTURE pyriform, outer lip simple and acute.

FIG. 46. FIG. 47.
Glandina convexa (S. V. Wood), Sconce, Isle of Wight; photographed by Mr. J. G. Randall, slightly reduced.

G. convexa varies considerably in size. Of the two specimens figured, the larger shell, indicated by the black spot on the body whorl (fig. 46) is the identical individual selected as type by Searles V. Wood for illustration in the Memoirs of the Palæontographical Society; its total height before loss of apex was probably 45 mill., as even now, after mutilation, it attains 40 mill.; its breadth is 21 mill. The aperture is 20 mill. long and 10 mill. in diameter. The smaller specimen (fig. 47) is 36 mill. long, and 17 mill. broad; its aperture 18 mill. long and 10 mill. wide.

ENGLAND AND WALES. *ISLE OF WIGHT.*

Oligocene—Bembridge limestone at Sconce (S. V. Wood, Pal. Soc., iv., p. 335, 1877). Bembridge, Hempstead, Whitecliff Bay, etc., C. Ashford, 1888.

1 Geologists speak of Sconce as if it were a geographical place. Sconce is a common noun, meaning a fort (to ensconce was to retire into the sconce for defence), and was applied to the defences of Tudor and Stuart times, which were often distinguished by the names of the erectors. This one is marked on some maps as Cary's Sconce (now demolished). The Bembridge limestone is exposed near its site, hence its notoriety, C. Ashford in litt., 1890.

Glandina brevis (Edwards MS.).

1891 **Glandina brevis** R. B. Newton, Syst. List Edwards' Coll., p. 275.

SHELL turbinate with an acute spire and rounded base; WHORLS five and half to six, somewhat convex and transversely striate, the last whorl a little more than half the total length of the shell; OUTER LIP simple; SUTURE distinct; APERTURE longitudinally pyriform, length, 20 mill.; diam., 10 mill.

Length of shell, 35 mill.; diam., 18 mill.

FIG. 48.—*Glandina brevis* (Edwards MS.), Sconce, Isle of Wight; photographed by Mr. J. G. Randall. slightly reduced.

Mr. Starkie Gardner records that the National Collection comprises upwards of sixty specimens of this species, which strikingly illustrate the great variability in the relative proportions of whorls and aperture.

BRITISH ISLES. *ISLE OF WIGHT.*

Oligocene—Bembridge limestone, Sconce (R. B. Newton, Syst. List Edwards' Coll., 1891, p 275).

LITERATURE.

Bourguignat, J. R.—Notice sur les espèces vivantes et fossiles du genre Testacella.—Rev. et Mag. Zool., Dec. 1861.

Cockerell, T. D. A.—The Variation and Abnormal Development of the Mollusca.—Science Gossip, 1885, pp. 224—5.

Collinge, W. E.—The Morphology of the Generative System of the Genus *Testacella*.—Ann. and Mag. Nat. Hist., xii., p. 21—25, pl. 1, 1893.

Cuvier, G.—Mémoire sur la Testacelle.—Annales Mus. d'Hist. Nat., 1804.

Edwards, F. E.—Monograph Eocene Mollusca, 1852.

Gassies & Fischer—Monographie du Genre Testacelle—Actes Lin. Soc. Bordeaux, 1856.

Lacaze-Duthiers, H.—Histoire de la Testacelle—Arch. Zool. Exper., v., pp. 459—596, pl. 29—40, 1887.

Massot, P.—Des Testacelles Françaises.—Annales de Malacologie, i., pp. 145—157, and pl., 1870.

Moquin-Tandon, A.—Hist. Nat. Moll. France, 1855.

Pollonera, C.—Di alcune Testacelle raccolte presso Torino.—Boll. Mus. Zool. Torino, 1888.

Osserv. intorno alcune specie di Testacella.—Boll. Mus. Zool. Torino, 1889.

Poulton, E. B.—Note upon the Habits of Testacella.—Nature, Oct. 28, 1886.

Simroth, H.—Die Nacktschnecken d. Portugiesisch-Azorischen Fauna, 1891.

On some Testacellae, J. of Conch., vol. vi., p. 423, Oct. 1891.

Taylor, J. W.—On the Specific Distinctness and Geographical Distribution of *T. scutulum*.—J. of Conch., v., p. 337—347, 1888.

Webb, W. M.—The British Species of Testacella.—J. of Mal., Dec. 1895, July 1897, and Dec. 1897.

On the Manner of Feeding in *T. scutulum*.—Zool., Aug. 1893.

Wood, Searles V.—Eocene Mollusca. 1877.

FAMILY LIMACIDÆ Gray.

Dr H. Simroth.

The family *Limacidæ* as here understood embraces the genera *Limax*, *Agriolimax* and *Amalia*, in addition to other groups foreign to our shores, and although now restricted in extent is not even yet a thoroughly homogeneous family, but the parallel course of shell degeneration and the marked convergence of the external form of the constituent genera renders their association convenient, at least until their true genetic relationships have been elucidated.

The great advances made in late years in our knowledge of these neglected creatures is largely due to the brilliant researches of Dr. Simroth, the eminent German limacologist, who has for years made the elucidation of this group an especial study.

Family Characteristics.—EXTERNALLY, the features possessed in common by the *Limacidæ* are the elongate, subcylindrical BODY; a more or less noticeable DORSAL KEEL, most pronounced at the caudal end; an anterior mantle or SHIELD which covers the pulmonary chamber, the heart, the kidney, etc., with the RESPIRATORY APERTURE on the right side, behind the middle of the mantle margin; SOLE longitudinally tripartite, mid-area locomotory; REPRODUCTORY ORIFICE behind the right ommatophore.

SHELL oblong or oval, white and slightly concave, with the nucleus at the posterior margin, but inclining towards the left side, from whence concentric lines of growth extend, which demonstrate that the external shell of which it is the vestige was spirally coiled; the Dendrolimaces of South Africa show more clearly the stages between the shelled and the naked species.

INTERNALLY, the NERVOUS SYSTEM is chiefly aggregated around the pharynx[1]; an important caudo-dorsal nerve arises from the pallio-abdominal commissure, extends along the length of the body, and is in intimate connection with the pharyngeal retractor; MANDIBLE oxygnathous[2]; LINGUAL TEETH numerous, arranged in median, lateral and marginal series and quite typical of the group Dichoglossa[3]; pharyngeal and tentacular RETRACTORS combined posteriorly and forming a common stem affixed to the dorsal integument behind the lung, and constituting with the testaceous forms the group Monorhiza.[4]

The *Limacidæ* is one of the groups which retain in adult life the primitive shell or protoconch[5] formed by the shell-gland of the embryo; and which also develop in the Gastrula[6] stage a well-marked caudal vesicle, whose rhythmical contractions assist the circulation of the body fluids prior to the developing heart becoming functional.

The shell is the *lapis limacum* of the Romans, and enjoyed great renown amongst the various remedies,[7] bezoars, and amulets[8] which ancient peoples held in high esteem either as specifics for the cure of various ailments or as charms protecting the wearer against accidents or disease.

1 Monog. i., p. 215, f. 424. 2 Monog. i., p. 255, f. 511. 3 Monog. i., p. 271, f. 543.
4 Monog. i., p. 343, f. 637. 5 Monog. i., p. 322. 6 Monog. i., p. 380, f. 717. 7 Monog. i., p. 427.
8 Monog. i., p. 433.

Food and Habits.—The habits of the *Limacidæ* are very various, some being almost subterranean in their mode of life, but all are nocturnal or crepuscular, only leaving their lurking places at eve or during damp and showery weather.

A characteristic feature of the *Limacidæ* is the plentiful secretion of mucus which may be utilized in the form of mucus filaments as a ready means of descent from elevated positions.[1]

Some of the species are eminently omnivorous, others are almost entirely restricted to fungi, while many will greedily devour such food when offered: indeed, Simroth affirms their original food to be the *Basidiomycetes*, and the fungiferous stratum of moss in forests, heaths and mountains to be their original head-quarters. All, however, are more or less inclined to a flesh-diet, and on occasion may be not only carnivorous or cannibalistic, but even predatory.

Parasites and Enemies.—Many animals prey upon the *Limacidæ*, Hedgehogs, Frogs, and Toads being great enemies, and Ducks and Geese very partial to them, while the Thrushes, Blackbird, Chaffinch, Starling, Plovers, Curlew, Woodcock, Whinchat, Coot, Quail, Oyster-Catcher, Landrail, etc., are all recorded as slug devourers. Blindworms (*Anguis fragilis*) and some of the larger Staphylinidæ also prey upon them; the Wood Ant has been observed to attack and overcome even the larger species, and larvæ of various dipterous flies are very destructive to them in the egg state.

Parasitic upon them are *Isospora rara*, a Gregarine, also *Davainea proglottina*, which is parasitic in the domestic fowl, but passes one of its stages within the body of a *Limax*: while a Nematoid worm, *Ascarioides limacis*, is said to be found within the egg. *Philodromus limacum*,[2] an Acarid, almost universally parasitic upon the land gastropods, is often particularly plentiful upon the different species of *Limacidæ*.

Geographical Distribution.—The *Limacidæ* are apparently of world-wide distribution, but it is probable that when their internal organization has been accurately ascertained, it will be found that the *Limacidæ* of distant regions are more primitive forms and not so closely related in structure to western palæarctic species as their external aspect appears to indicate.

GENUS *LIMAX* Linné.

History.—The term *Limax* (*Limax*, a slug; according to Brumati, the equivalent Italian word *Lumaca* is derived from *limus*, dirt, clay, or mud) was originated or instituted by Linné to distinguish one of the five great groups into which he classified the Mollusca.

This broad application of the term has, however, from time to time been restricted until it is now used to more especially distinguish the species centreing around *Limax maximus*.

Generic Characters.—EXTERNALLY, the Limaces are distinguished by their more or less distinctly maculate or longitudinally fasciate BODY; their thin INTEGUMENT; their long and slender TENTACLES markedly bulbous at the apex; DORSAL FURROWS distinctly marked, arising beneath the mantle and terminating at front of head, where they form the FACIAL GROOVES[3]; MANTLE or shield anterior, about one-third of total length of body, concentrically wrinkled, with a sub-posterior nucleus; MUCUS clear or stained with red or yellow.

SHELL elongate or ovoid in shape, white, slightly concave; APEX posterior, inclined to left side, and slightly attached to animal; lines of growth concentric and occasionally well marked.

1 Monog. i., p. 316. 2 Monog. i., p. 123, f. 738. 3 Monog. i., p. 186, f. 360.

INTERNALLY, *Limax* is especially characterized by the gut possessing five coils, in addition to the œsophageal or stomach tract, an arrangement distinguished by the term Pentadroma[1]; its first and second courses are held in position by the cephalic aorta, as is usual in gastropods, the third and fourth tracts being retained anteriorly by encircling the pharyngeal retractor, the whole gut displaying no indication of the spiral twisting to which in the past it has been undoubtedly subjected.

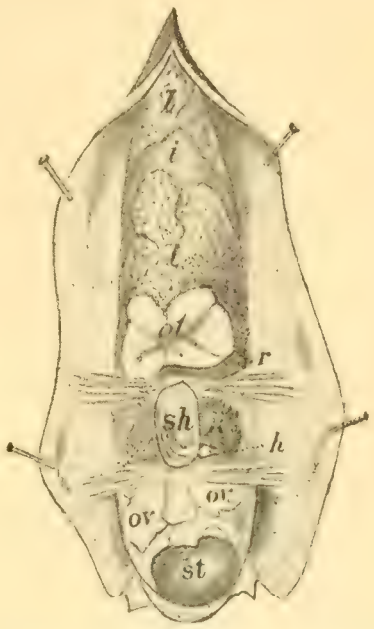


FIG. 50.—*Limax flavus* L., as contracted after scalding, laid open dorsally to show the arrangement of the internal organs.
st. crop or functional stomach; *ov.* oviduct; *ot.* ovotestis; *sh.* shell; *h.* heart; *r.* rectum; *i.* intestine; *k.* kidney; *l.* liver.

The REPRODUCTIVE ORGANS are simple, with few accessory parts, and according to Babor undergo in most species a cycle of development, the animal being first unisexual, and only subsequently hermaphrodite, but may finally again become unisexual by the atrophy of the organs of the sex to which the animal originally belonged; the PENIS SHEATH is somewhat long, and the PENIS and VAGINA are separated by the right tentacular retractor; SPERM DUCT a complete tube, not incomplete as in *Arion*; circulatory system, according to Semper, shows a single oval blood sinus beneath; the SUPRA-PEDAL mucus gland is imbedded in the foot and extends the whole length of the body; ATRIUM short.

The HEART and LUNG are constructed as in *Helix* and *Hyalinia*; the KIDNEY is a simple sac with laminate margins and furnished with a well-marked and distinct SECONDARY URETER.[2]

Geographical Distribution.—*Limax* is naturally a western palæarctic group, and in its dispersal strikingly evidences the truth of our location of the most active evolutionary area in North Central Europe, for we find the most highly organized forms prevailing there, fringed around with allied but more simply organized and weaker species, whose progenitors have probably been expelled therefrom or otherwise have taken refuge in more or less undesirable localities, as with the primitive *L. tenellus*, which though still found in North Central Europe, is now almost exclusively restricted to the limits of the pine forests.

The higher organization and greater adaptability of the dominant species of *Limax* is shown by their quickly becoming accustomed to new surroundings when accidentally transported to other countries, and gradually extending their range to the detriment and dispossession of the weaker aboriginal species.

Geological History.—The genus *Limax* has been recorded as fossil from deposits as ancient as the Lower Miocene of Germany, and from other beds of more recent formation.

In the British Isles this genus has been recorded by Morris from the Mammalian Crag at Stutton; it has also been found in the Lower Pleistocene of East Anglia, in the Middle Oligocene of the Hampshire Basin, and various other deposits.

1 Monog. i., p. 285, f. 569. 2 Monog. i., p. 336, f. 628.

Limax maximus Linné.

1678 *Limax cinereus, maximus, striatus & maculatus* Lister, Hist. Anim. Angl., p. 127, tit. and fig. 15.
1737 *Cochlea nuda domestica* Swamm., Bibl. Nat., i., ch. 13, p. 158, tab. 8, ff. 7, 8, 9.
1740 *Limax cellaria* D'Argenville, Conch., p. 386, pl. 28, f. 31.
1756 *La Limace cendrée, striée et tachée de noir et de brun* Guet., Mém. Ac. Sc., p. 147.

1758 **Limax maximus** L., Syst. Nat., ed. x., i., p. 652.
1774 — *cinereus* Müll., Verm. Hist., ii., p. 5, no. 202.
1789 — *fasciatus* Razoumousky, Hist. Jorat, vol. i., p. 267.
1819 — *antiquorum* Fér., Hist. Moll., p. 68, pl. 4, ff. 1-8.
1837 — *cyrenæus* Campanyo, Bull. Phil. Perpignan, iii., p. 88.
1837 — *maculatus* Nunneley, Trans. Phil. Soc. Leeds, i., p. 46, pl. 1, f. 2.
1845 — *sylvaticus* Morelet, Moll. Port., p. 33.
1815 *Limacella parma* Brard, Coq. Paris, p. 110, pl. 4, ff. 1, 2, 9, 10.
1876 — *maxima* Jousseaume, Bull. Soc. Zool. France, p. 97.
1868 *Eulimax maximus* Malm, Lim. Scand., pp. 54-57, pl. 4, ff. 10-10f.

Lionel E. Adams.

HISTORY.—*Limax maximus* (*maximus*, greatest) is, as its name implies, one of the largest species of the genus, and has been known in this country for more than two centuries. Merret, in 1667, first enumerated it as one of our native species, and Lister, in 1678, figured and ably described it under a polynomial appellation, the first part of which—*Limax cinereus*—has frequently been disassociated from the rest of the epithets and used as a binomial term.

Upon the erroneous assumption that this species does not occur in Sweden, Dr. Westerlund concludes that *Limax cinereo-niger* is the true *Limax maximus* of Linné, and on this ground he applies the term *maximus* to *cinereo-niger*, and uses the word *cinereus* to designate the present species.

Diagnosis.—Externally, *Limax maximus* may be distinguished from *L. cinereo-niger* by the body being typically pale and longitudinally zoned with black; the shield maculate or marbled by dark colouring; the sole uniformly pale; the keel confined to the caudal end of the body, and the rugosities small, fine, and quite closely set.

Internally, the shell is distinctly narrower and more elongate; the penis sheath is distally swollen, very rigidly flexed, and its retractor said to have a different point of fixation; the lingual teeth differ from those of *cinereo-niger* by their more aculeate character, and by their cutting-points more quickly alternating with those of the adjacent rows; and the mandible is larger, stronger, and distinctly rectangular in shape at the ends.

It is also more sluggish in habit, has not so wide a range in altitude or space, and is more closely associated with man and his habitations than the closely-allied *L. cinereo-niger*, with which it has been so often united.

From *Limax marginatus*, better known as *L. arborum*, it is distinguished by its much longer and more slender tentacles, and by its spotted shield, that of *marginatus* being invariably longitudinally banded; while internally it is sharply differentiated by the presence in *marginatus* of a short conical flagellum to the penis-sheath and a cœcal appendage to the rectum.

Dr. Scharff has also indicated a ready method of discrimination to be by touching the front of the mantle, which the animal at once raises up and almost inverts. This peculiar action does not occur with *L. marginatus*, in which the mantle is more intimately united with the body.

Description.—ANIMAL with a long and slender BODY, tapering towards the tail, and varying in length from 100 to 150 mill., but occasionally reaching to even 200 mill.; usually of a yellowish-grey or cinereous ground colour, variously banded or maculated with black, but sometimes unicolorous; BODY rounded, but keeled towards the caudal end, with about forty-eight longitudinal rows of elongate, detached tubercles; NECK pale, with two conspicuous DORSAL FURROWS enclosing a single row of elongate tubercles and terminating in front as the FACIAL GROOVES; SOLE uniformly pale; FOOT-FRINGE pale with a row of minute submarginal blackish tubercles; TENTACLES very long and slender; SHIELD oblong, about one-third the total length of the animal, rounded in front, angular behind, and forming an angle of about 80 deg. when in motion, usually of a similar tint to the body, but boldly marbled or maculate with black, somewhat concentrically and interruptedly ridged around a sub-posterior nucleus. MUCUS colourless and iridescent, not very adhesive, and less plentiful than in *L. flavus* or *L. marginatus*.

SHELL placed beneath the hinder part of the shield and perceptible through the skin, oblong-oval, thin, of a whitish colour, slightly convex above, and correspondingly concave beneath, with a membranous margin; APEX or nucleus at the posterior margin but inclined towards the left side, and forming the apophysis by which the shell is organically attached to the animal. Length, 13 mill.; breadth, 7 mill.

FIG. 52.—Internal shell of *Limax maximus* L., × 1½. Christchurch, Hants.

INTERNALLY, the NERVOUS SYSTEM is composed of the typical ganglia; the pedal ganglia are placed beneath the radula sac and joined together by an anterior and a posterior commissure; the abdominal ganglion lies a little to the right of the median line; the visceral ganglia occupy the angle between the lingual sheath and the œsophagus, and the buccal ganglia are widely separated but joined together by a commissure nearly as thick as the ganglia themselves.

The OLFACTORY SENSE is chiefly lodged in the tentacles, yet according to Simroth there are within the mantle chamber well-marked vestiges of the primitive smelling-organ or OSPHRADIUM in the form of a simple yellowish ridge furnished with a double fringe of nerves and placed to the left of the anal aperture.

The REPRODUCTIVE ORGANS are simple; the OVOTESTIS or hermaphrodite gland on left upper side of liver, is very large, narrowly linguiform, many lobed, with very small, rounded, darkly pigmented follicles; DUCT long, slender, and straight above, thickened and sinuous below, usually white; ALBUMEN GLAND large lobed, of an amber colour and placed on right side along the crop; OVISPERMATODUCT long and comparatively narrow, only slightly connected together in the lower half and sometimes naturally disjunct, resembling *Limax flavus* in this respect; OVIDUCT portion puckered into short, rounded segments; SPERM-DUCT thick, cream-white, most conspicuous below; FREE-OVIDUCT short, the lower thickened part furnished internally with annular glands; SPERMATHECA club-shaped, blotched with opaque-white and amber, its crown fixed by muscular threads to ovispermatoduct, its stem short, joining free oviduct at its very base; PENIS-SHEATH long, upper half opaque-white, thickened and rigidly convoluted, lower half narrow, semi-transparent white, tinged with bluish or brownish near external orifice, and furnished with a crest interiorly, which is most pronounced at the upper end, its retractor, which is the chief cause of the spiral twisting of the penis when protruded, is a stout band arising from left side of root of columella retractor, and attached terminally to penis-sheath; VAS DEFERENS enters close to retractor.

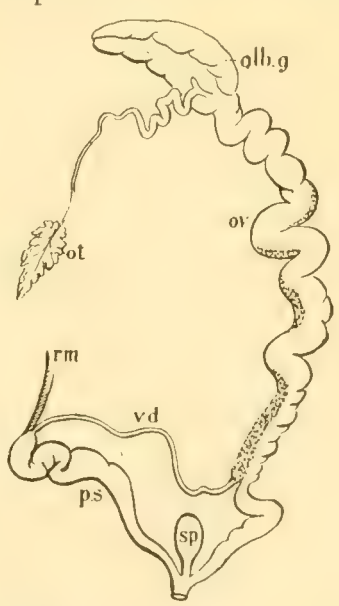


FIG. 53.—Sexual organs of *Limax maximus* L.
(Beverley, Yorks., Mr. J. D. Butterell).
alb.g. albumen gland; *ov.* oviduct; *ot.* ovotestis; *p.s.* penis sheath; *r.m.* retractor muscle; *sp.* spermatheca; *v.d.* vas deferens.

The CEPHALIC RETRACTOR[1] arises beneath the posterior extremity of the mantle, in one or more roots, which quickly unite into a broad pearly-white band, but about mid-way divides into a pharyngeal and two tentacular branches. The PHARYNGEAL muscle passes through the nerve-ring, and divides, to become fixed on each side of the pharynx. The TENTACULAR RETRACTORS each give off a branch to the anterior tentacle of their respective sides, which send slips to the labial lobes. The broad coloured part of the muscular sheath of the ommatophore is clearly defined from the tentacle, and contains the ocular muscle and the convoluted optic nerve when the eye is retracted.

ALIMENTARY CANAL[2] with short ŒSOPHAGUS; CROP long, darkish-brown, with longitudinal and transverse wrinkles, contracted before and enlarged at the first bend which represents the true stomach and receives the bile ducts; SALIVARY GLANDS whitish, large, compact and not deeply lobed; the GUT has five courses or tracts in addition to the stomach tract, which is the longest, the first intestinal tract increases disproportionately in length with age, and thus becomes larger in comparison with the succeeding coils which only grow in correspondence with other parts of the body, the third tract, instead of forming the rectum, as is usual in gastropods, turns around the cephalic retractor and runs back free over the surface of the visceral mass, and then finally bends into the forward tract, constituting the rectum.

MANDIBLE or jaw horny-brown, about four mill. broad and one mill. wide at its narrowest part, strongly arched anteriorly, with a strong, pointed, central beak or rostrum, which projects boldly beneath, ends distinctly rectangular with the corners rounded off, line of bedding in upper jaw shown by a broad darker brown line parallel with the upper margin.

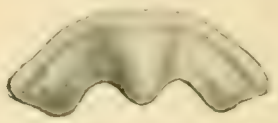


FIG. 54.—Mandible or jaw of *L. maximus* L., × 8.
(Beverley, Mr. J. D. Butterell).

The LINGUAL MEMBRANE is of an elongate oval shape, ten mill. long and about five mill. wide, beset with closely-set teeth, which decrease very slightly in size, and are arranged in transverse rows which gently curve backwards as the margins are approached; median row with hour-glass shaped base of attachment and a broad reflection bearing a strong central cup or mesocone,[3] side cusps sub-obsolete without perceptible cutting points; lateral teeth with strong mesocone, the endocone[4] showing as an acutely prominent angle, but without cutting point; ectocone[5] obsolete;

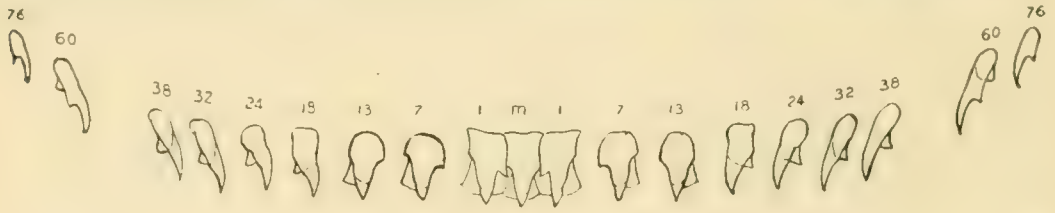


FIG. 55.—Representative teeth from a transverse row of the lingual teeth of *Limax maximus* L. × 120. The animal collected by Mr. C. Oldham, at Knutsford; the radula prepared by Mr. W. Moss, and photographed by Mr. T. W. Thornton.

the lateral bicuspid teeth gradually become more aculeate in character, and about the twentieth row the apices begin to alternate with those of the adjacent rows; at the forty-eighth row they begin to bifurcate, continuing thus to the margins.

The dental formula of a Knutsford specimen, collected by Mr. C. Oldham, is

$$\frac{34+28+20+1+20+28+34}{2\quad 1\quad 2\quad 3\quad 2\quad 1\quad 2} \times 168 = 27{,}660.$$

Habits, etc.—This species is not gregarious, and frequents gardens, damp and shady hedgerows and woods, hiding during the day beneath stones, under fallen trees, or other obscure and damp places; it, however, exhibits a decided preference for the vicinity of human habitations, and readily takes up its abode in damp cellars or outbuildings.

In Ireland, this predilection for human dwellings is not exhibited, the species being said by Scharff to be restricted to woods and other similar places, and may even be met with almost within high-water mark on the sea-shore.

The HOMING faculty is strongly developed in this species, which, after its nocturnal rambles or foraging expeditions, usually returns to the particular

1 Monog. i., p. 344, f. 637. 2 Monog. i., p. 285, f. 569. 3 Monog. i., p. 152. 4 Monog. i., p. 152. 5 Monog. i., p. 152.

crevice or chink in which it has established itself; as shown by their slime-tracks, these animals in the course of their peregrinations often form a loop

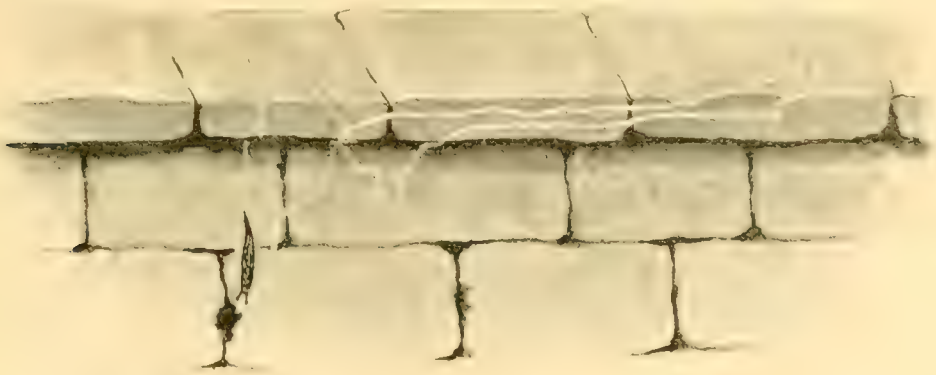


FIG. 56.—Mucus-track, twenty feet or more in length, of *Limax maximus* L., observed by Mr. L. E. Adams, upon the boundary wall of the Churchyard, Clifton, Derbyshire, July 8, 1898, illustrating the homing propensity.

or figure of 8, the return track crossing the outward one at some point, usually near to the chosen home.

The OLFACTORY sense is strongly developed in the Limaces, the keen perception of *Limax maximus* being established by the well-known experiment of Moquin-Tandon.[1] Striking confirmation of this acuteness of their olfactory faculty is related by Mr. L. E. Adams, who, about ten o'clock, one dark, windy, and wet evening in August, 1897, at Clifton, Derbyshire, saw a *Limax maximus* crawling directly towards a plate upon the lawn, containing the remains of the dog's dinner; when first observed the slug was about six

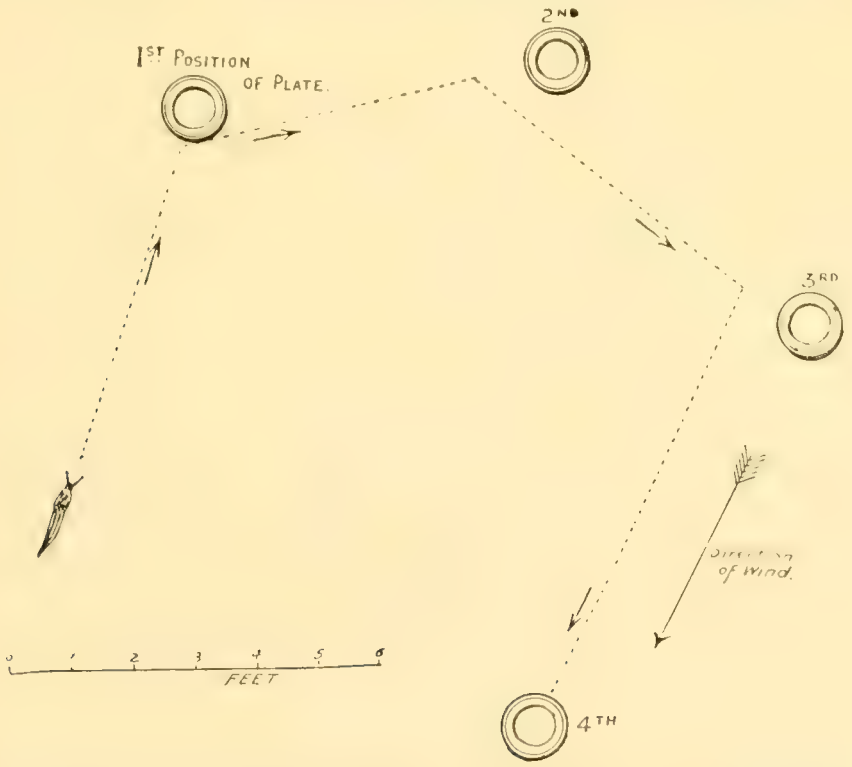


FIG. 57.—Diagram of the route traversed by *Limax maximus* L., in following the changes of position of a plate of food, as observed by Mr. L. E. Adams, at Clifton, Derbyshire.

feet distant from the plate, but within thirty minutes had reached it; the plate was then moved to a second position, about six feet away, but in another direction; the slug almost immediately changed its course, and

1 Monog. i., p. 229.

again made straight towards the plate, on again nearing it the same process was repeated with the same result, the plate being finally removed and placed in a fourth position, eight feet away, and directly to the leeward of the slug, yet in a little more than half-an-hour the slug had reached the plate.

Food.—*L. maximus* is very omnivorous, and though, according to Simroth, as a rule refusing plants containing chlorophyll, it has been observed by Mr. E. J. Lowe to devour the young and tender foliage of *Adiantum*, Petunias, Pansies, Chrysanthemums, Cucumbers, French Beans, Tobacco plants, Dahlias, and other garden plants; the leaves of the Cauliflower when turning yellow are also sought after.

It also greedily devours fungi, which, indeed, are said to form its staple diet and to be preferred to other food. In Mr. Gain's experiments[1] upon the food of British mollusks, he offered this species 196 different plants, of which 157 were totally rejected, and only two—*Boletus edulis* and root of carrot—were eaten with avidity. It has also been observed by Dr. Scharff to devour *Russula emetica*.

It evinces a great preference for kitchen refuse, and shows especial partiality for custards, milk, bread, raw or cooked meats, and other articles of human food, and even makes its way into fruit rooms to feed upon the fruit stored there; it also not uncommonly visits the "sugar" placed by the lepidopterist upon the trunks of trees to attract the night-flying moths.

Reproduction and Development.—The act of conjugation in *Limax maximus* is very remarkable,[2] though it is probable that analogous processes are indulged in by their close allies. The operation, though noticed to occur at various times during the day, usually takes place towards midnight.

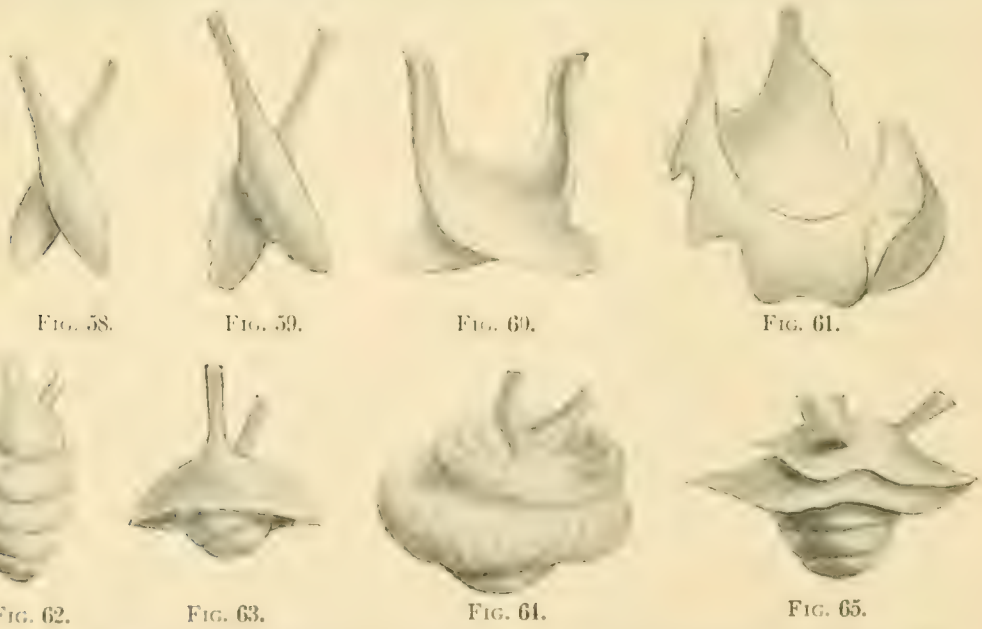


Fig. 58. Fig. 59. Fig. 60. Fig. 61.

Fig. 62. Fig. 63. Fig. 64. Fig. 65.

Serial changes of form undergone by the male organ of *Limax maximus* L., prior to and during conjugation (after nature sketches by Mr. Lionel E. Adams).

Fig. 58.—Aspect of the penes immediately after protrusion from the body. Fig. 59.—Shows the commencement of the appearance of the frill. Fig. 60.—Frill partially unrolled. Fig. 61.—Frill completely expanded, preparatory to twisting together. Fig. 62.—Penes tightly coiled together, forming the whorled knot. Fig. 63.—The succeeding umbrella-form. Fig. 64.—Umbrella-form with horizontal margins reversed. Fig. 65.—Umbrella-form with double margins.

The animals seeking to pair would seem to be cognisant of the presence of a prospective partner even when a considerable distance away, as they make straightway towards each other; when the animals meet, they mutually caress with their tentacles, after the manner of ants, and forthwith begin to

1 J. of Conch., April 1891, pp. 349-361. 2 Monog. i., p. 373, f. 689.

crawl in a circular procession, their mantles flapping before and behind, continuing thus from half-an-hour to two hours-and-a-half or more, each with its mouth at the other's tail, and eating the mucus from its partner's body; the circle becomes gradually more and more contracted and the animals more and more excited, until suddenly the slugs intertwine their bodies and launch themselves head downwards into space, but are restrained from falling by a strong mucus cable of a brownish colour, attached to the caudal end of the body, which gradually lengthens until it is from fifteen to eighteen inches long, and is a continuation of the thick bed of slime exuded during the prolonged circular promenade.

Directly they are suspended, both slugs protrude the milk-white male organ, which, though cylindrical at first, quickly assumes a club-shape (fig. 58); a frilled edge (fig. 59) appears, and the unwinding is gradually and quickly completed (figs. 60, 61), the unrolled organs now intertwine closely round each other and form a whorled knot (fig. 62), and the two upper whorls spread out, in umbrella fashion, leaving the lower portion of the knot as before (fig. 63). The two upper whorls, however, sometimes do not overlap, but curve in different directions (fig. 64), and sometimes may be nearly horizontal but separate (fig. 65). The slugs now hang motionless with flaccid and contracted tentacles, while the two upper outspread whorls of the knotted penes keep revolving one upon another, and in this extraordinary manner the liquid semen is transferred and the mutual act consummated. After a lapse of five to ten minutes the organs unwind, roll up, and are withdrawn into the body; while the slugs, which appear greatly exhausted, either drop to the ground or climb up the thread to the point of support, the thread itself sometimes being afterwards devoured.

Shortly after pairing a number of eggs are deposited at the roots of trees, plants, or grass, beneath stones, and in other moist and suitable situations; they are agglomerated together in heaps or clusters, or may form a long chaplet, by being attached together at their poles by a viscous mucus. They are roundly oval, about five mill. by four mill., of a translucent amber colour, and of a jelly-like consistency and appearance, but gradually becoming duller and more opaque.

They hatch in about a month, the young being usually of a yellowish tint with four distinct lateral bands, which extend to the posterior third of the shield, and assume a horse-shoe shape, but during growth become broken up, especially upon the left side; the ground colour also gradually changes in some districts, becoming of a wood-brown, often tinged with red, finally becoming duller and the bands more obscure; in other districts or under suitable conditions the immature colourings and decided banding of the young stage may be preserved to adult life.

Parasites and Enemies.—In addition to the enemies and parasites of the group previously enumerated, this species is infested by a Nematode (*Leptodera flexilis*), which lives within the salivary glands.

Another species, *Leptodera angiostoma* Schneider, is found in the rectum, and according to Creighton the larvæ have been found imbedded in a dense mass of glycogenous cells, surrounding the pedal artery.

Geological History.—*Limax maximus* has been reported by Tournouër as found fossilized in France in the Middle Pleistocene of La Celle, near Moret, Seine et Marne.

In England it has also been recorded from the Pleistocene deposits at Grays, in South Essex, and from those of the Ightham fissure in West Kent, by Mr. Abbott.

It has been noticed in a Holocene deposit at Reigate by the Rev. R. Ashington Bullen; in a hill-wash at St. Catherine's Down, in the Isle of Wight, by Mr. J. S. Bowerbank, in 1836; and also in a modern marine deposit, Pegwell Bay, in East Kent, by Mr. Alfred Bell.

Variation.—The variation of *Limax maximus* is in many respects analogous with the band variation of the pentatæniate Helices, and shows similar traces of having passed through parallel stages of colouration; the banding exhibiting many of the same peculiarities, and being capable of expression by a similar numerical formula.

In its highest development *L. maximus* may be considered as triple-tinted, its primitive or fundamental colouring being probably a somewhat uniform yellowish, greyish, or reddish tint, varying in harmony with the environment and the temperature to which the animal has been subjected during its growth period. The second stage was probably the development of paired lateral bands overlying the lateral blood sinuses and presumed to derive their pigmentation from the action of the atmosphere upon the mass of blood beneath the skin; these bands, which are regarded by Simroth as an ancient badge of the Pulmonates, may, by concentration of pigment, form a lighter area on each side and thus lead to the establishment of darker zones, one on each side of the primitive one, thus constituting the three typical longitudinal bands, which may be distinguished as the inner, main, and outer bands, or formulated by the numerals 1, 2, 3, referring to their position in regard to the median dorsal line. The bands may at any stage become broken up into spots, or by diffusion more or less completely overspread and obscure the primitive ground colour; to be eventually overspread or embellished by the superposition of a tertiary stage of colouring, which, as before, first appears in a position coincident with that of the chief lateral blood sinuses.

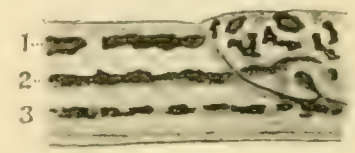


FIG. 66.—Portion of body of *Limax maximus* L., to show band formula.

Many varieties still retain the paler secondary banding upon which the darker tertiary markings are superposed, but by marginal concentration of pigment each tertiary band may become resolved into a slender double line or a double row of spots, which border each of the paler secondary bands, and give a similar aspect to that of the *Helix hortensis* figured in vol. i., p. 99.

In this country the ground tint is usually some shade of ash-grey, but brighter shades are occasionally met with, which would seem to be atavistic, or a retention in mature life of immature colourings; the line of variation is, however, chiefly in the intensity and character of the dark markings.

Its size has also been observed by Locard to vary according to the altitude of its abode, the animal being smaller in size when living in elevated localities. Dr. Baudon has remarked on the differences in size, and created a var. *gigantea* for some unusually large specimens found at Mouy, in the department of the Oise. Similar examples have been found in this country, one found by Mr. Quilter in Belvoir Castle gardens exceeding eight inches in length.

The varieties of *Limax maximus* are grouped in three series: according to the ground colour of the body; the character of the dark markings; and to accommodate examples in which these two factors exist together in unusually striking combination.

It should not, however, be overlooked by the student that the following list by no means exhausts the variations that may be met with, as the various ground tints may be associated with any of the different markings and con-

sequently give rise to an almost infinite number of sub-varieties, which will necessarily partake of or unite the characters of two or more of the more important varieties, and such varietal names as are applicable may be used in combination to indicate them.

VARIATIONS IN COLOUR OF ANIMAL.

Var. **concolor** Pini, Moll. Esino, 1876, p. 82.

Limax unicolor var. *concolor* Pini, l.c.
Limax unicolor var. *bivonæ* Less. & Poll., Mon. Limac. Ital., 1882, p. 26.
Limax maximus var. *limbata* Moquin-Tandon, Moll. France, 1855.

ANIMAL almost uniformly ash-coloured; foot-fringe, keel, and neck paler.

The brownish-chestnut coloured *Limax unicolor* var. **bivonæ** of Less. & Pollonera from Palermo in Sicily may be relegated to this form. The sub-variety **limbata** Moquin-Tandon is also this variety in which the foot-fringe is whiter than is usual. The var. *cinerea* of Moquin-Tandon does not belong to this species.

Cornwall W.—Phillack, near Hayle, Oct. 1884 ! Miss S. Hockin.
Hants S.—Christchurch, June 1884 ! C. Ashford.
Sussex W.—Worthing, Aug. 1884 ! T. D. A. Cockerell.
Kent W.—Chislehurst, Sept. 1884 ! T. D. A. Cockerell.
Surrey—Charles Hill, Farnham, July 1883 ! S. Spencer Pearce.
Middlesex—Acton, Aug. 1884 ! Willesden, Jan. 1885 ! Bedford Park, Chiswick, Feb. 1885 ! T. D. A. Cockerell. Churchyard Bottom Wood, Highgate, June 1889 ! H. W. Kew.
Northampton—Northampton, Sept. 1884 ! W. D. Crick.
Stafford—Gardens, Cheadle, April 1896 ! F. B. Webb.
Leicester—Hathern, Sept. 1884 ! C. T. Musson. Canal Side, Belgrave, July 1885 ! H. E. Quilter.
Lincoln N.—Louth, Sept. 1886 ! H. W. Kew.
Cheshire—Bowdon ! (Milne & Oldham, J. of Conch., Jan. 1894).
Lancashire S.—Farington, locally common, May 1889 ! W. H. Heathcote.
York S.W.—Haw Park, Sept. 1885, J. Wilcock.
York Mid W.—Charleston, near Bingley (Soppitt & Carter, Nat., p. 97, 1888). Near Shipley Glen, Oct. 1887 ! J. A. Hargreaves. Boston Spa, May 1885 ! W.D.R.
Westmorland and Lake Lancashire—Coniston, Oct. 1886 ! W.D.R.
Renfrew—Shielhill Glen, Aug. 1886 ! W.D.R. Harelaw Burn, Gleniffer, Aug. 1890 ! J. M. B. Taylor.
Haddington—Falside, Aug. 1886 ! W.D.R.
Stirling—Cambusbarron, near the mill, July 1894 ! A. McLellan.
Aberdeen N.—Haddo House, Dec. 1890 ! Geo. Muirhead.
Main Argyle—Dunoon, common, Aug. 1886 ! W.D.R.
Sutherland E.—Golspie Burn, June 1886 ! W. Baillie.
Dublin—Dublin, March 1886 ! J. R. Redding.
Wexford—Kilmanock, Sept. 1888 ! G. Barrett-Hamilton.
Westmeath—Killynon, Sept. 1886 ! W. F. de Vismes Kane.
Galway E.—Killeran (B. J. Clarke, Ann. and Mag. Nat. Hist., 1843).
Clare—Ballyvaughan, July 1895 (Standen, Irish Nat., Sept. 1895).

The var. *concolor* has also been observed in France, Germany, Norway, Denmark, Italy, Sicily, Austro-Hungary, Balkan Peninsula, etc.

Var. **candida** Less. & Poll., Monog. Limac. Ital., 1882, p. 26.

ANIMAL pure white and slightly transparent, showing some of the viscera through the skin; EYES pale brown.

Limax unicolor var. *candidus* Lessona & Pollonera, l.c.
Limax maximus var. *alba* Adams, J. of Conch., July 1896, p. 228.

This or a closely-allied variety was named *albus* by Amstein and *megaspidus* by Blainville.

Northampton—Rockingham Park, May 1896 ! (L. E. Adams, Journ. Northants. Soc., June 1896, p. 60).
Italy—Novoli, near Florence, M. Paulucci (Lessona & Pollonera, l.c.).
France—Savigny-sur-Orge, Seine et Oise (P Fischer, J. de C., Oct. 1880, p. 299).

Var. **vinosa** Baudon, J. de Conch., July 1884, p. 204.

ANIMAL purplish or vinous-brown.

The sub-var. **lilacina** of Roebuck, in which the ground colour is lilac or purplish, may be regarded as a form of this variety with the dark markings of var. *krynickii*.

Gloucester E.—Sub-var. *lilacina*, Stroud, Oct. 1883 ! E. J. Elliott.
York S.E.—Beverley, Oct. 1884 ! J. Darker Butterell.
France—Angy in the Oise and Arlanc in the Puy-de-Dôme, Brevière (Baudon, l.c.).

Var. **nigra** Dum. & Mort., Cat. Moll. Savoie, 1857, p. 15.

ANIMAL unicolorous black or blackish

Lancashire S.—Walton-le-Dale, June 1889! W. H. Heathcote.

France—St. Gervais, Haute Savoie, Dr. Brot (D. & M., l.c., 1857, p. 14).

VARIATIONS IN MARKINGS OF ANIMAL.

Var. **fasciata** Raz., Hist. Jorat, 1789, p. 267.

Limax maximus var. *continuatus* Dum. & Mort., Mal. Savoie, 1857.

ANIMAL pale ash-coloured, with three darker-coloured bands on each side; SHIELD maculate or marbled. This variety is usually described as black, with five longitudinal whitish bands.

The sub-var. **mulleri** Moq. may be regarded as a form of this variety with the addition of a double row of black spots. Moquin-Tandon's description, notwithstanding his reference to Muller, is more applicable to a form of this species than of *cinereo-niger*.

The var. *fasciata* of Lessona has the median and lower bands on each side coalesced, and superficially resembles the var. *tetrazona*.

Channel Isles—Sub-var. *mülleri*, St. Sampson's, Guernsey, Sept. 1891! B. Tomlin.

Devon S.—Sidmouth! R. Rosenstock.

Hants S.—Christchurch, Sept. 1884! and Tuckton, July 1885! C. Ashford.

Hants N.—Sub-var. *mülleri*, Preston Candover, July 1884! H. P. Fitzgerald.

Kent W.—Hever, near Edenbridge, Feb. 1898! A. Leicester.

Middlesex—Sub-var. *mülleri*, Churchyard Bottom Wood, Highgate, June 1889! H. Wallis Kew.

Suffolk E.—Blaxhall, July 1885! G. T. Rope.

Norfolk E.—Holt, July 1893! Tom Petch.

Bedford—Luton, General Cemetery, Apl. 1889! J. Saunders.

Worcester—Great Malvern, July 26, 1902! C. Waterfall.

Stafford—Cheadle, Apl. 1886! F. B. Webb. Handsworth, Apl. 1885! G. S. Tye. Stafford, L. E. Adams.

Glamorgan—Aberkenfig, Aug. 1890! G. K. Gude. Cardiff, Nov. 1889! F. Wotton.

Leicester—Belvoir Castle gardens, and cellars Leicester (Quilter, Moll. Leic., 1881).

Nottingham—Corporation Gardens, Nottingham (Dodd, Brit. Ass. Hdbk., 1893). Tuxford, July 1885! W. A. Gain.

Derby—Winster (H. Milnes, J. of Conch., Oct 1893).

Lincoln N.—Haugham wood, April 1886! W D.R. Lincoln road, Louth, April 1886! H. W. Kew. Parson's-lane, Alford, May 1886! J. E. Mason. Mother-wood, Aby, taken at 'sugar,' June 1891! J. Burtt Davy.

Cheshire—Bowden and Baguley Hall! (Milne & Oldham, J. of Conch., Jan. 1894). Marple, May 1891! L. St. G. Byne. Sub-var. *mülleri*, Sale, in nursery gardens, Feb. 1895! C. Oldham.

York S.E.—Beverley, Oct. 1884! J. Darker Butterell. Sledmere, Aug. 1891! F. W. Fierke.

York N.E.—Easby Wood, July 1890! J. Hawell. Kildale Woods! and Ingleby Greenhow! July 1890, B. Hudson. Yearby Wood, April 1889! W.D.R.

York S.W.—Penistone, Nov. 1889! L. E. Adams.

York Mid W.—Starbotton, Wharfedale, May 1886! W.D.R.

York N.W.—Ivelet Bridge, Swaledale, June 1890! W.D.R.

Merioneth—Bont-ddu, near Dolgelly, Sept. 1886! F. G. Fenn.

Wigtown—Springbank, near Stranraer, Sept. 1890! W. Evans.

Ayr—Maybole, Sept. 1890! W. Evans

Renfrew—Shielhill Glen, Aug. 1886! W.D.R.

Peebles—Walkerburn, Aug. 1886! W.D.R. Peebles, July 1890! W. Evans.

Selkirk—Near Selkirk, Oct. 1890! W. Evans.

Edinburgh—Dreghorn woods, near Colinton, Sept. 1889! Colinton road, Morningside, Edinburgh, June 1890! W. Evans.

Fife and Kinross—St. Andrews, July 1890! W. Evans.

Stirling—Cambusbarron, near the mill. July 1894! A. McLellan.

Perth N.—Bridge of Cally, July 1890! W. Evans.

Perth Mid—Annat Lodge, Perth! H. Coates.

Forfar—Dundee, outskirts, July 1890! W. Evans.

Aberdeen N.—Haddo House, Dec. 1890! Geo. Muirhead.

Banff—Tomintoul, Sept. 1891! W. Evans.

Elgin—Grantown, Aug. 1891! W. Evans.

Clyde Isles—Rothesay, May 1887! T. Scott.

Ebudes S.—Lorgh Ba House, near Port Charlotte, Islay, Nov. 1890! W. Evans.

Antrim—Cushendun, May 1886 ! S. A. Brenan.
Donegal—Carrablagh, Croaghross, near Letterkenny, May 1889 ! H. C. Hart.
Louth—Piperstown, in greenhouse, Oct. 1889 ! Miss Sidney Smith.
Dublin—Glen Druid, near Carrickmines, Oct. 1886 ! W. F. de V. Kane.
Sligo—Collooney, Sept. 1885 ! W. F. de V. Kane.
Mayo W.—Enniscoe demesne, near Crossmolina, Sept. 1885 ! W. F. de V. Kane.

The var. *fasciata* has been recorded from Switzerland, Piedmont, and Eastern and Pyrenean France.

Var. **sylvatica** Morelet, Moll. Port., 1845, p. 33.

Limax sylvaticus Morelet, l.c.
Limax antiquorum var. *czernaëvii* Kaleniczenko, Bull. Mosc., 1851, xxiv., p. 123.
Limax maximus var. *vulgaris* Moq.-Tand., Hist. Moll. France, 1855, ii., p. 28.
Limax maximus var. *serpentina* Moq.-Tand., l.c.
Limax maximus var. *quadrifasciata* Dum. & Mort., Cat. Moll. Savoie, 1857, p. 14.

ANIMAL ash-coloured, with two continuous black bands on each side and a more indistinct or broken band beneath ; SHIELD spotted or marbled with black.

The sub-var. **serpentina** of Moquin-Tandon only differs from characteristic var. *sylvatica* by the main or median band of each side being more sinuous and irregular.

Channel Isles—Herm (Reeve, Brit. Moll., 1863, p. 26 and fig.).
Cornwall W.—Pennion, Falmouth, April 1884 ! H. Fox. Scilly Isles, Rev. E. D. Roberts, Aug. 1890 (G. Sheriff Tye).
Wilts S.—Vicarage Garden, Steeple Ashton, March 1887 ! E. P. Knubley.
Oxon—Henley road, Watlington, and at Pyrton (Norman, Zool., 1853, p. 4127).
Northampton—Garden, Northampton, May 1883 ! W. D. Crick. Rockingham Park, May 1896 ! L. E. Adams.
Stafford—Stafford, June 1886, and Dec. 1897, L. E. Adams.
Salop—Whittington Castle, Oswestry, June 1885 ! B. Hudson.
Lincoln N.—Well Vale, April 1886 ! W.D.R. Broughton, near Brigg, Aug. 1902! Miss F. H. Woolward.
Lincoln S.—Near Boston, Sept. 1884 ! W.D.R.
Leicester—Near Leicester, June 1885 ! H. E. Quilter.
Notts.—Tuxford, July 1884! W. A. Gain. Pleasley Vale, April 1884 ! C. T. Musson.
Cheshire—Holmes Chapel, Nov. 1896 ! C. Oldham.
Lancashire S.—Victoria Park, Manchester, March 1884 ! R. D. Darbishire.
York N.E.—Kirkleatham, Sept. 1886 ! W.D.R. Hayburn Wyke, Aug. 1894 ! F. W. Fierke.
York Mid W.—Torquay terrace, Headingley, July 1884 ! W. E. Clarke.
York S.E.—Garden, Pitt street, Barnsley, Oct. 1884 ! G. Rose.
Westmorland, etc.—Grange, April 1884 ! Coniston, Oct. 1886 ! W.D.R.
Berwick—Fans, near Earlston, Oct. 1883 ! R. Renton.
Stirling—Cambusbarron, near the mill, July 1894 ! A. McLellan.
Forfar—Near Montrose, July 1884 ! W. Duncan.
Westerness—Glenborrodale, Dec. 1891 ! J. J. Dalgleish.
Antrim—Cushendun and Whitehall, Broughshane, June 1886 ! S. A. Brenan.
Queen's County—La Bergerie (B. J. Clarke, Ann. N.H., 1840, p. 203).
Galway—(B. J. Clarke, Ann. N.H., 1840, p. 203).
Waterford—Near Waterford, Sept. 1883 ! J. H. Salter.

This variety is the most prevalent form in this country and abroad.

Var. **tetrazona** Taylor.

ANIMAL ash-coloured, with only two bands on each side ; SHIELD maculate or marbled.

The var. *fasciata* of Lessona, though also showing only two bands on each side, is different, being a three-banded form, the lowermost being compound and formed by the union of the main and outer bands.

York S.E.—Beverley, Sept. 1884 ! J. Darker Butterell.
Cheshire—Nursery gardens, Sale, Feb. 1895 ! C. Oldham.

Var. **krynickii** Kaleniczenko, Bull. Moscow, 1851, p. 122.

Limax antiquorum krynickii Kaleniczenko, l.c.
Limax maximus var. *johnstoni* Moq.-Tand., Hist. Nat. France, 1855, p. 29.
Limax maximus var. *bifasciatus* Dum. & Mort., Cat. Moll. Savoie, 1857, p. 14.
Limax maximus var. *pallido-dorsalis* Adams, Manual, 1896, p. 34.

ANIMAL ash-coloured, mid-dorsal area paler, with a few black spots, inner band distinct and black, main and outer bands obsolete ; SHIELD maculate.

The sub-var. **bifasciata** D. & M. has also only one well-marked band on each side, the other being effaced.

Hants S.—Christchurch, Sept. 1884! C. Ashford.
Gloucester E.—Stroud, Oct. 1883! E. J. Elliott.
Stafford—Cannock Chase, June 1886! L. E. Adams.
Selkirk—Near Selkirk, Oct. 1890! W. Evans.
Edinburgh—Dreghorn woods, near Colinton, Sept. 1889! and Colinton road, Morningside, June 1890! W. Evans.

On the Continent, this form has been found in France, Italy, Switzerland, at Kharkov in Russia, and in Madeira.

Var. **cellaria** d'Argenville, Conch., 1740, p. 386, pl. 32, f. 31.

Limax cellarius d'Arg., Conch., 1740, p. 386, pl. 32, f. 31.
Limax antiquorum var. ϵ Fér., Hist. Moll., tab. 20.
Limax cinereus var. *maculatus* Picard, Moll. Somme, 1840.
Limax maximus var. *interruptus* Dum. & Mort., Moll. Savoie, 1857, p. 14.

Fig. 67.—*Limax cellaria* (after D'Argenville).

Animal pale ash-coloured; shield maculate with black; body with interrupted longitudinal zones of the same colour on each side.

With this variety may be associated the var. **maculata** of Picard, in which the shield and body are maculate with black, and which only differs from the strictly typical var. *cellaria* by the more distinctly detached and more rounded character of its markings.

The sub-var. **interrupta** of D. & M. differs by the addition of longitudinal rows of small spots alternating with the banding characteristic of the variety.

Channel Isles—Guernsey, Sept. 1893! (Tomlin, J. of C., April 1894, p. 361).
Cornwall W.—Truro, Dec. 1885! J. H. James. Scilly Isles, Rev. E. D. Roberts, Aug. 1890! (G. Sherriff Tye).
Hants S.—Christchurch, Sept. 1883! C. Ashford.
Kent E.—Folkestone, Sept. 1886! C. Oldham.
Surrey—Croydon, Nov. 1883! Kenneth McKean.
Middlesex—Upper Holloway, in a mushroom house, July 1890! and sub-var. *maculata* Churchyard Bottom Wood, Highgate, June 1890! H. W. Kew.
Bucks.—Shalstone, June 1885! H. P. Fitzgerald.
Norfolk W.—King's Lynn, Nov. 1886! C. B. Plowright.
Hereford—Bishopswood Vicarage, Ross, April 1885! R. W. J. Smart.
Warwick—Ingon Grange, Stratford-on-Avon, Sept. 1884! R. J. Attye. Hagley road, Birmingham, Aug. 1886! J. Madison.
Stafford—Stafford, June 1886! L. E. Adams. Cheadle, April 1886! F. B. Webb.
Salop—Minsterley, Aug. 1885! L. E. Adams. Ellesmere and Oswestry, June 1885! Baker Hudson.
Glamorgan—Cardiff, Nov. 1889! F. W. Wotton.
Pembroke—Deer park and Heywood lane, Tenby (Stubbs, J. of C., July 1900).
Carnarvon—Trefriw and Conway Castle, July 1883! W.D.R.
Denbigh—Llangwystenin and Tal-y-Cafn, July 1883! W.D.R.
Lincoln S.—Ancaster, April 1886! W.D.R.
Lincoln N.—Alford, April 1886! W.D.R. Louth, April 1886! H. Wallis Kew. Broughton, near Brigg. Aug. 1902! Miss F. H. Woolward. Kirton-in-Lindsey, Aug. 1902! E. A. Woodruffe-Peacock. Somersby, Sept. 1889! W.D.R.
Leicester—Hathern, Sept. 1884! C. T. Musson. Canal banks, Belgrave, July 1885! Cellars, West street, Leicester, Oct. 1885! Lime quarries, Barrow-on-Soar, and Mountsorrel, Oct. 1885! and Spinney Hill, near Leicester, Sept 1887! H. E. Quilter. Evington! and near Wigston! (Quilter, Moll. Leicestershire, 1888, p. 20).
Notts.—Basford, Sept. 1884! Beauvale Abbey, Sept. 1884! Annesley Park, Sept. 1884! Wilford, Oct. 1884! and cellars. Nottingham, May 1885! C. T. Musson. Garden, Tuxford, July and Sept. 1885! W. A. Gain. Farnsfield, Southwell, Sept. 1892! C. Oldham.
Derby—Winster, High Peak, July 1885! Rev. H. Milnes.
Cheshire—Bowdon, May 1885! J. G. Milne. Wythenshawe, 1886! C. Oldham. Sale, in nursery gardens, Feb. 1895! C. Oldham.
York S.E.—Gardens, Westwood, Beverley, Sept. 1884! J. Darker Butterell.
York N.E.—Farwath Bridge, Newtondale, Aug. 1886! W.D.R.

York S.W.—Barnsley, Oct. 1886 ! W. E. Brady. Lofthouse, 1885 ! G. Roberts. Ackworth, June 1883 ! Hugh Richardson. Bradford, July 1893 ! Percy Lund. Huddersfield, in cellar, Sept. 1885 ! G. T. Porritt. Keighley, greenhouse at Cliffe Castle, Oct. 1890 ! T. Hebden.

York Mid W.—Victoria road, Hyde Park, Leeds, 1887 ! T. K. Skipwith. Washburndale, July 1885 ! W.D.R. Cellar, North Stainley Vicarage, Oct. 1884 ! R. A. Summerfield. Eavestone, Oct. 1884 ! J. Ingleby. Garden, Staveley Rectory, Oct. 1885 ! E. Ponsonby Knubley. Sleningford, April 1896 ! W.D.R. Mickley village, Aug. 1889 ! W.D.R.

Durham—The common form about Durham, April 1884 ! Baker Hudson.

Northumberland—Museum grounds, Newcastle, Sept. 1888 ! R. Howse.

Westmorland—Coniston, Oct. 1886 ! W.D.R.

Ayr—Glen App, near Ballantrae, July 1884 ! Baker Hudson.

Renfrew—Shielhill Glen, Aug. 1886 ! W.D.R.

Peebles—Eddleston, July 1889 ! W.D.R.

Roxburgh—Melrose Abbey, June 1886 ! J. Madison.

Perth N.—Sub-var. *maculata*, Blairgowrie, July 1890 ! W. Evans.

Forfar—Montrose, July 1884, W. Duncan.

Westerness—Glenborrodale, Dec. 1891 ! J. J. Dalgleish.

Wexford—Kilmanock, Aug. 1888 ! G. Barrett-Hamilton.

The var. *cellaria* has been reported from many parts of France, Germany, and Italy, as well as from Sardinia, Corsica, Madeira, and New South Wales.

Var. **ferussaci** Moquin-Tandon, Moll. France, ii.; p. 29, pl. 4, f. 5.

Limax cinereus var. *punctatus* Esmark, J. of Conch., Oct. 1886 p. 101.

ANIMAL pale ash-coloured, shield with small rounded black spots ; BODY with two or sometimes three longitudinal rows of small and round black spots on each side (figured, Monog. i., pl. 1, f. 5).

The sub-var. **punctata** only differs from *ferussaci* in the fewness and consequent apparent irregularity of the spots upon the shield and body, while the sub-var. nov. **geminipunctata** is characterized by their greater abundance, the increase of those upon the body being due to the splitting up of the originally large spot, which gives a paired aspect to the markings.

Cornwall W.—Gardens, Truro, April 1886 ! J. H. James.

Somerset S.—Bridgwater, Aug. 1884 ! W. Vinson.

Surrey—Sutton, July 1885 ! F. G. Fenn.

Middlesex—Churchyard Bottom Wood, Highgate, Aug. 1889 ! H. Wallis Kew. Garden at 5, Giesbach road, London, N., Aug. 1890 ! H. Wallis Kew.

Norfolk W.—Starston, specimens in Brit. Museum (Cockerell, Nat., Aug. 1888).

Salop—Oswestry, June 1885 ! Baker Hudson.

Lincoln S.—Brandon Lodge, Grantham, Jan. 1889 ! T. Burtt.

Leicester—Hathern, Sept. 1884 ! C. T. Musson.

Notts.—Tuxford, July 1885 ! W. A. Gain.

York Mid W.—Sleningford, April 1896 ! W.D.R.

Westmorland and Lake Lancashire—Coniston, Oct. 1886 ! W.D.R.

Anglesea—Llanfaes, Sept. 1886 ! J. G. Milne.

Carnarvon—Abersoch ! (C. Oldham, J. of Conch., Jan. 1898).

Kirkcudbright—Maxwelltown, common in cellar, July 1891 ! R. Service.

Selkirk—Thornielee railway station, Aug. 1886 ! W.D.R.

Edinburgh—Cramond Island, Sept. 1888 ! T. Scott.

Antrim—Colin Glen, near Belfast, June 1884 ! S. A. Stewart. Dunluce Castle ; Plantation Park, Kenbane ; common, Murlough Bay ; Church Bay, Rathlin Island, R. Welch, May 1902. Cushendun, May 1886 ! S. A. Brenan. Cushendall, Aug. 1894 ! W. Moss.

Down—Crawfordsburn, May 1902; common in Castle Yard and plantations, Ardglass, 1897 ; Oakleigh, Ormeau Park, Belfast; Hillsborough Castle Park, April 1902, R. Welch, May 1902.

Armagh—June 1885 ! H. W. Lett.

Donegal—Ardara, April 1900, R. Welch.

Wexford—Kilmanock, Sept. 1888 ! G. Barrett-Hamilton.

Leitrim—Glencar, E. Collier & G.W. Chaster, Sept. 1900, R. Welch, May 1902.

Galway E.—Churchyard, Monivea (B. J. Clarke, Annals N.H., 1840, p. 203).

Cork—R. Ball (B. J. Clarke, Annals N.H., 1843, p. 334).

Kerry—Killowen Church, Kenmare, May 1898, R. Welch. Kenmare demesne ; Loo Bridge and island in Middle Cloonee Lake (Standen, Irish Nat., Sept. 1898).

On the Continent, this variety has been reported from France, various parts of Italy, the Tyrol, South Norway, and Poltava and Tchernigov in Russia.

Var. **aldrovandi** Moquin-Tandon, Moll. France, 1855, ii., p. 29.

ANIMAL ash-coloured with pale spots.

This variation is due to the incomplete overspreading of the secondary colouring, which leaves the ground tint visible in places in the form of paler spots. It is by no means certain whether the var. *aldrovandi* described by Moquin-Tandon belongs to this species or to *cinereo-niger*, as the meagre description is applicable to forms of both species.

Dorset—Portland, Aug. 1886 ! J. Madison.
Gloucester W.—Bristol, June 1884 ! C. Waterfall.
Isle of Man—Douglas, Sept. 1892 ! F. Taylor.

This variety has also been observed in France.

Var. **obscura** Moquin-Tandon, Moll. France, 1855, p. 31.

Limax maximus var. *nebulosus* Dum. & Mort., Moll. Savoie, 1857, p. 14.
Limax unicolor var. *sordidus* Less. & Poll., Monog. Limac. Ital., 1882, p. 26.

ANIMAL with longitudinal banding indistinct, obscured by the diffusion of the darker colouring.

Northants—Common in cellars, Northampton, Sept. 1884 ! W. D. Crick. Kettering (L. E. Adams, Moll. Northants, 1896, p. 5).
Gloucester E.—Leckhampton, May 1885 ! J. Madison.
Gloucester W.—Stroud, Oct. 1883 ! E. J. Elliott.
Glamorgan—Cardiff, Nov. 1889 ! F. W. Wotton.
Montgomery—Welshpool, under planks, Aug. 1889 ! J. Bickerton Morgan.
Lincoln N.—Alford, Sept. 1885 ! J. E. Mason.
Cheshire—Alderley Edge, Oct. 1897 ! Sale, Sept. 1894 ! C. Oldham.
Has also been recorded for France, Italy, and Switzerland.

VARIATIONS IN COLOUR AND MARKINGS OF ANIMAL.

Var. **bicolor** Taylor.

Ground colour of ANIMAL white ; MANTLE maculate with black ; and BODY banded or blotched with same colour.

Isle of Man—Port Erin, 1881, L. E. Adams.

This variety has also been observed on the continent by Dr. Simroth.

Var. **tigris** Adams MS.

ANIMAL of a tawny-yellow colour, with black markings.

York S.E.—Beverley, Oct. 1884 ! J. Darker Butterell.
Stafford—Stafford, L. E. Adams, Sept. 1897.

Antrim—Slope of Knocklayd Mountain, Ballycastle, July 1897, Dr. Trumbull. R. Welch, May 1902.

Geographical Distribution.—*Limax maximus* is dispersed throughout Europe, and has been recorded for Asia Minor, Transcaucasia and Algeria.

It has also been introduced by commerce into the United States, Mexico, Cape Colony, Australia, Tasmania, New Zealand, and the North Atlantic Islands.

According to Bourguignat, the Algerian specimens are not really *maximus*, but *Limax deshayesii* ; those from the Canaries are *Limax abrostolus* Bourg., and the Azorean specimens *Limax eubalius* of the same author.

In the British Isles this species is universally distributed, being found in all the three kingdoms, and extending into quite remote districts.

ENGLAND AND WALES.

Channel Isles—Guernsey and Sark (Cooke & Gwatkin, Q J.C., 1878, vol. i., p. 322). Jersey, Herm, Jethou, and Crevichon (Lukis in Ansted, 1862).

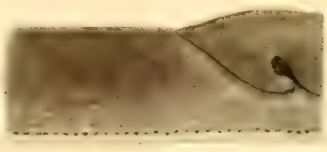
PENINSULA.

Cornwall W.—Common ; frequently in damp corners of cellars and sculleries (Marquand, Moll. W. Cornwall, 1884, p. 4). Pennion, Falmouth, April 1884 ! Herbert Fox. St. Columb Porth, near Newquay ! and Truro ! J. H. James, Dec. 1888.
Devon S.—Plymouth (J. C. Bellamy, Plymouth list, 1837). Exeter, common in gardens, outhouses, etc. (E. Parfitt, Nat., 1854, p. 150).
Devon N.—Combe Martin and Challacombe (J. R. B. Tomlin, J. of Conch., v., p. 181, April 1887). Northam, Nov. 1885 ! W. A. Gain.
Somerset S.—Bridgwater, Aug. 1884 ! W. Vinson.

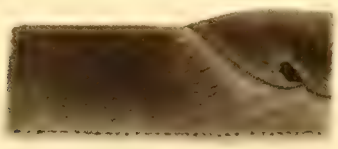
LIMAX MAXIMUS L.

1.—*Limax maximus var. sylvatica=typical form, p. 43.*
Well Vale, Lincolnshire.

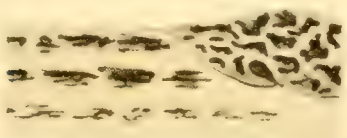
2.—*Limax maximus var. candida, p. 41.*



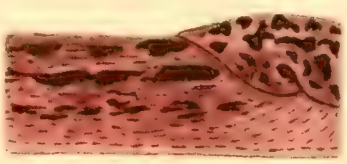
3.—*Limax maximus var. concolor, p. 41.*



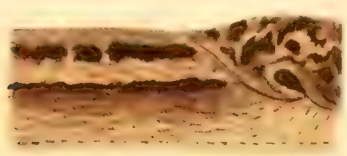
4.—*Limax maximus var. nigra, p. 42.*



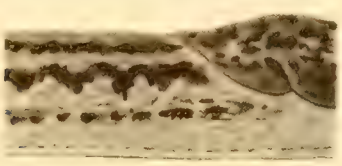
5.—*Limax maximus var. bicolor, p. 46.*



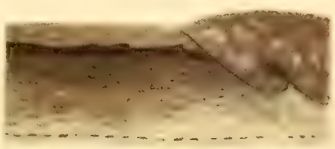
6.—*Limax maximus var. vinosa, p. 41.*



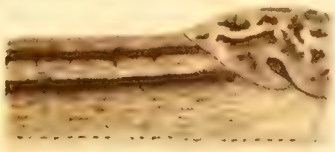
7.—*Limax maximus var. tigris, p. 46.*



8.—*Limax maximus sub.-var. serpentina, p. 43.*

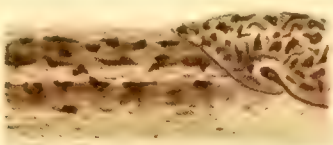


9.—*Limax maximus var. kinnickii, p. 43.*

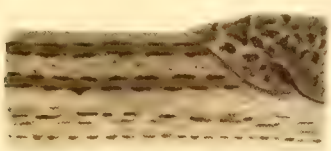


10.—*Limax maximus var. tetrazona, p. 43.*

11.—*Limax maximus var. fasciata, p. 42.*



12.—*Limax maximus sub.-var. punctata, p. 45.*



13.—*L. maximus sub.-var. geminipunctata, p. 45.*

14.—*Limax maximus var. obscura, p. 46.*

15.—*Limax maximus var. aldrovandi, p. 46.*

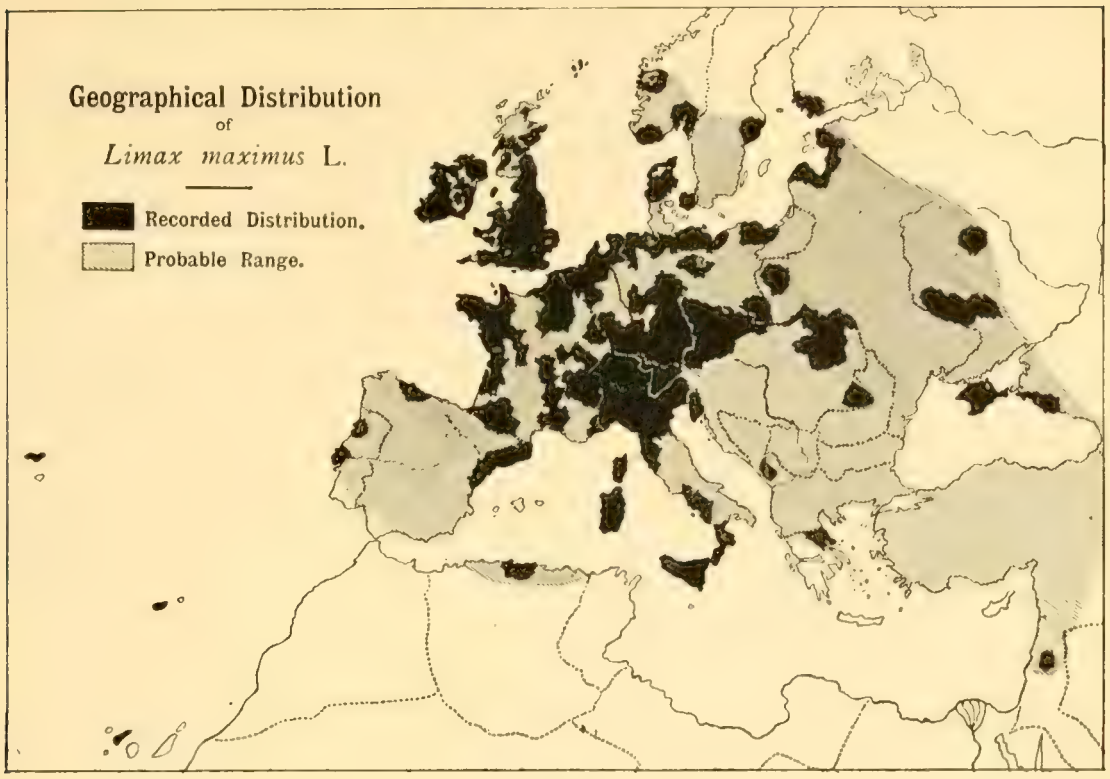


Fig. 68.

Somerset N.—Common (A. M. Norman, 1860). Common around Bratton St. Maur (E. W. Swanton, Conch., i., p. 57, Dec. 1891).

CHANNEL.

Wilts S.—Salisbury, common (J. E. Vize, Wilts. Mag., 1866, p. 278). Vicarage garden, Steeple-Ashton, March and June, 1887 ! E. Ponsonby Knubley.

Dorset—Generally distributed (J. C. Mansel-Pleydell, Moll. Dorset, 1898, p. 4). Chideock, Bridport, Aug. 1885 ! A. Belt.

Isle of Wight—Enumerated as common by G. Guyon (Venables' Guide to the Isle of Wight, 1860, p. 401).

Hants S.—Christchurch, common, Jan. 1883 ! and Vinney Ridge, New Forest, June 1887, C. Ashford. In forest, Cadnam, J. H. Ashford ; Beaulieu (C. Ashford, J. of Conch., Jan. 1887, p. 159). Woods, Winchester, 1883, B. Tomlin.

Hants N.—Preston Candover, Oct. 1884 ! H. P. Fitzgerald.

Sussex W.—Generally distributed, frequenting outhouses and cellars in damp situations (Harting, Zool., March 1878, p. 87). Beech plantation, Downs, Ratham, common, July 1884 ! W. Jeffery.

Sussex E.—Lewes, in gardens, cellars, etc. (W. C. Unwin, Nat., 1853, p. 54). Brighton (W. C. Unwin in Merrifield's Nat. Hist. of Brighton, 1860). Hastings (A. W. Langdon, Nat. Hist. of Hastings, 1878, p. 13). Ouse, Cuckmere and East Rother districts (J. H. A. Jenner, J. of Conch., March 1880).

THAMES.

Kent E.—Faversham, Sept. 1884 ! Miss Fairbrass. Davington, near Faversham, E. Collier, Sept. 1885. Folkestone, Sept. 1886 ! C. Oldham.

Kent W.—Common in W. Kent, T. D. A. Cockerell, Apl. 1883. Sevenoaks, not uncommon (R. H. S. Smith, Zool., 1854, p. 4332). Common, Chislehurst ! (T. D. A. Cockerell, Nat. Hist. Notes, Nov. 1882, p. 171). In a cellar near Cobham, Leach, Syn., p. 52, 1852 ! (Brit. Mus., Sept. 1886). Kingsdown, Sept. 1891, L. E. Adams. Maidstone (Elgar & Lamb, J. of Conch., Jan. 1893).

Surrey—Wray Park, near Reigate (G. S. & E. Saunders, 1861), Charles Hill ! and Waverley, near Farnham, very common, July 1883, S. Spencer Pearce. Haslemere, Aug. 1884 ! T. D. A. Cockerell. Croydon, Oct. 1885 ! S. C. Cockerell. Grayswood, E. W. Swanton (Pannell. J. of Conch., April 1902).

Essex S.—Becontree Hundred (W. Crouch, Essex Nat., Dec. 1890). Near Abbey Wood (Jenkins, Essex Nat., Nov. 1891). Brentwood (Reeve, Brit. Moll., 1863, p. 26). High Beach, Epping, Apl. 1890 ! H. W. Kew.

Essex N.—Witham, 1833 (Loudon's Mag., Oct. 1834, p. 535). Frequent in ash-pits, woods, and damp places about Colchester (H. Laver, Essex Trans., 1882, p. 93). Saffron Walden (Saffron Walden Museum, G. N. Mayman).

Herts.—Garden, Kingsbury, St. Albans, July 1884, John Hopkinson. Hitchin, March 1886! C. Ashford. Ware (Jeffreys, Moll. Herts., 1884, p. 31)

Middlesex—Bedford Park, Chiswick, Dec. 1884! and Acton, Jan. 1885! T. D. A. Cockerell. Whetstone! (Brit. Mus., Sept. 1886). Giesbach road, Upper Holloway, July 1890; Churchyard Bottom Wood, Highgate, May 1890; and Hampstead, June 1888! H. Wallis Kew. Harrow, May 1888! G. Barrett-Hamilton.

Berks.—Maidenhead, very common, 1880, L. E. Adams.

Oxford—Scarce about Oxford, but large and abundant in the south of the county (J. F. Whiteaves, 1857, p. 5). Not uncommon in Henley road, near Watlington, and at Pyrton (A. Merle Norman, Zool., 1853, p. 4127). Not uncommon in damp places about Banbury (R. Stretch, Zool., 1855, p. 4541).

Bucks.—Chersley, Apl. 1883! H. H. Slater. Castlethorpe, May 1885! W. D. Crick

ANGLIA.

Suffolk E.—Exceedingly common, Woodbridge, May 1886! S. Spencer Pearce. Mendlesham parish, in crevices of old stone walls (A. Mayfield, Norfolk Trans., 1902, p. 350). Blaxhall, G. T. Rope.

Suffolk W.—Hardwick (C. Greene, Suffolk list,, 1891).

Norfolk E.—Frequent under stones about Norwich (W. K. Bridgman, Zool., 1850, p. 2742). Whitlingham, common, T. Reeve, Feb. 1886. Long Stratton, Aug. 1890, L. E. Adams. Bedon! A. Mayfield. 1891. Under logs, Yelverton; Howe, near Whitlingham Church, S. Spencer Pearce; Kirby-Bedon and Heigham, A. Mayfield (Pearce & Mayfield, J. of Conch., July 1894, p. 393).

Norfolk W.—Starston, Harleston, Rev. W. Whitear (Leach, Syn. Brit. Moll., 1852, p. 52). Lynn, Sept. 16, 1886! C. B. Plowright.

Cambridge—Whittlesea and Isle of Ely (Bellars, Brit. Shells, 1858).

SEVERN.

Bedford—Luton, May 1887! J. Saunders (Midl. Nat., June 1888, p. 153).

Northampton—Common throughout (L. E. Adams, Moll. Northampton, 1896, p. 5). Towcester, A. Loydell, 1881. Old walls and cellars, East Haddon, J. E. Roberts (L. E. Adams, op. cit.). In gardens and cellars, Northampton, May 1883! W. D. Crick.

Gloucester E.—Cheltenham (W. Webster, Nat., 1854, p. 175). Common at Stroud, March 1884! E. J. Elliott. Birdlip Woods, Aug. 1892, L. E. Adams.

Gloucester W.—Common, Redland, T. G. Ponton, 1864; gardens, Clifton, Miss Jones (Leipner's Bristol list, 1875). Stroud, Oct. 1883! E. J. Elliott.

Hereford—Not very common, Doward Hill (A. E. Boycott, Sci. Goss., 1892, p. 78). Fairly common, have taken it "at sugar" in Hereford (Boycott & Bowell, Hereford list, 1899).

Worcester—Malvern, not uncommon, E. Lees (Griffith's Malvern list, 1870, p. 159). Breeden Cross, Stirchley; near Alcester! Blakeley Hall, and Lea Hall, Yardley! Warwick road, Greet! Stratford road, May 1867! canal path, Acock's green, May 1867! Black lane, Kingsheath! and Sarehole! all near Birmingham, W. Nelson. Mosby, Oct. 1884! J. Madison. Selly Oak, Feb. 1893! L. E. Adams. Sparkbrook (G. S. Tye, Q.J.C., May 1875).

Warwick—Erdington, May 1867! and Beggarly Green, Olton, July 1871! near Birmingham, W. Nelson. Edgbaston (G. S. Tye, Q.J.C., May 1875). Solihull, Feb. 1893, L. E. Adams. Sutton Coldfield (A. Wood, Moll. Sutton Coldfield, 1897).

Stafford—Common in most cellars (Garner, Nat. Hist. of Staff., 1844, p. 301). Banks of Rushall canal, near Walsall! W. Nelson. Dudley and Handsworth (G. S. Tye, Q.J.C., May 1875). Stafford, in garden and cellar, May 1885, L. E. Adams. Barlaston Hall, Stoke-on-Trent, July 1888! and Cheadle, June 1888! J. R. B. Masefield.

Salop—Common (T. C. Eyton, Ann. and Mag. Nat. Hist., Feb. 1840). Whittington Castle, June 1885! Baker Hudson. Minsterley, 1885! L. E. Adams. Commonest slug about Forden and Gungrog Dingle, Welshpool (Morgan, 1888, p. 232).

WALES SOUTH.

Glamorgan—Whitchurch, etc. (F. W. Wotton, J. of Conch., April 1888, p. 54). Aberkenfig, Aug. 1890, G. K. Gude, H. W. Kew, June 1902.

Pembroke—St. David's, July 1891, J. Bickerton Morgan. Fairly plentiful about Tenby, A. G. Stubbs, Feb. 1896. Near Pembroke, June 1885! Mrs. Trayler. Penally, H. R. Wakefield, 1901.

Cardigan—Aberystwyth, May 1888! (E. Collier, J. of Conch., Oct. 1888, p. 354).

Montgomery—Forden, June 7, 1888! J. Bickerton Morgan. *WALES NORTH.*

Merioneth—The Gardens, Palé, Corwen, May 1887! T. Ruddy.

Carnarvon—Bettws-y-Coed, Aug. 1865! C. Ashford. Conway Castle, Jan. 1888! L. E. Adams.

Denbigh—Tal-y-Cafn, July 1883! W. D. R.

Anglesey—Llanfaes, Sept. 1886! J. Grafton Milne.

TRENT.

Lincoln S.—Near Boston, Sept. 1884 ! W.D.R.

Lincoln N.—Common, Bottesford (E. A. Woodruffe-Peacock, Nat., May 1901, p. 157). Well Vale, Alford, April 1886 ! W.D.R. Maltby Wood, near Louth, May 1890, and Wragby, Aug. 1888 ! H. W. Kew. Kirton-Lindsey, May and August 1902 ! E. A. Woodruffe-Peacock. Frodingham, July 1902, W.D.R. Tothill, May 1888 ! Miss Allott. Broughton, near Brigg, Aug. 1902 ! Miss F. H. Woolward.

Leicester—Leicester (Bellars, British Shells, 1858). Market Bosworth (Power, Linn. Trans., 1808, p 323). Canal side, Belgrave, June 1885 ! H. E. Quilter Cellar, West street, Leicester, Oct. 1895 ; New Parks, near Leicester (H. E. Quilter, Moll. Leicester, 1888, p. 20). Gumley Wood, A. Merle Norman, 1884.

Notts.—Welbeck, R. A. Rolfe, 1883. Highfield House, Bramcote, Beeston, Chilwell, Sawley, Thrumpton, Nottingham, etc. (Lowe, Notts. list, 1853). Worksop, April 1884 ! Felley Abbey, Sept. 1884 ! Annesley churchyard, Sept. 1884 ! Staunton, June 1886 ! Pleasley Vale ! and Cresswell Crags, April 1884 ! Lenton ! and Tollerton, C. T. Musson. Tuxford, April 1885 ! W. A. Gain. Mansfield, E. Pickard, Feb. 1884. Nottingham Corporation garden, Wells road, July 1888 ! G.W. Mellors. Southwell, Minster yard, Sept. 1892 ! C. Oldham.

Derby—Marple, May 1885 ! and Miller's Dale, Aug. 1885 ! C. Oldham. Winster, Aug. 1885, H. Milnes. Buxton, Sept. 1887 ! T.W. Pocock. Clifton, in gardens and cellars, June 1889, L. E. Adams. Matlock, H. E. Craven, and Darleydale, R. Standen (H. Milnes, J. of Conch., Oct. 1893). Markland Gripps, 1884 ! C. T. Musson.

MERSEY.

Cheshire—Chester (Bellars, Brit. Shells, 1858, p. 8). Marple, Sept. 1888 ! Knutsford, March 1902 ! C. Oldham. Bowdon ! and Sale ! in gardens and yards (Milne and Oldham. J. of Conch., Jan. 1894, p. 316).

Lancashire S.—Common in wall-crevices in autumn, Victoria Park, Manchester, L. E. Adams, 1885. Very large in cellar at Greenheys, and in greenhouse, Victoria Park, R. D. Darbishire, 1885. Farington, June 1888, W. H. Heathcote. Southport, (McNicoll, Southport list, 1859, p. 147). Chorlton, J. R. Hardy, 1885. Plentiful about Liverpool (Liverpool Nat. Scrap-Book, 1863-4, p. 55). Burnley (F. C. Long, The Garner, Jan. 1892). Whalley, June 1889 ! W. H. Heathcote.

Lancashire W. Grimsargh, June 1888, W. H. Heathcote. Fleetwood, Sept. 1891, L. E. Adams.

HUMBER.

York S.E.—Abundant at Newport, near Staddlethorpe, Aug. 1883 ! T. K. Skipwith. Common in gardens, Westwood, near Beverley, Sept. 1884 ! J. D. Butterell. Not common, Long lane, Beverley (J.D.B., Q.J.C., April 1882). Cellars and outhouses, Hornsea (J.D.B., Q.J.C., April 1881, p. 136). Common in gardens, Hull and Hornsea (J.D.B., Nat., Dec. 1878). Kirkham Abbey, Sept. 1899 ! W.D.R.

York N.E.—Common, Wilton Wood, July 1884 ! Baker Hudson. Thornaby (id., J. of Conch., April 1886). Kirkleatham, Sept. 1886 ! W.D.R. Whitby, abundant, July 1883 ! H. Pollard. Feliskirk, near Thirsk (J. H. Davis, Nat , 1855, p. 134). Castle Hill, Scarboro', Aug. 1888, B. Tomlin. Castle Hill, Pickering, Aug. 1886 ! and Farwath Bridge, Aug. 1886 ! W. D. R. Linton-on-Ouse (J. Ranson, Zool., 1861, p. 7819). Common about York (R. M. Christy, Zool., 1881, p. 242). Malton, July 1884 ! W.D.R.

York S.W.—Generally distributed about Bradford, Saltaire, Bingley and Steeton (Soppitt & Carter, Nat., 1888, p. 97). Wilsden, March 1884, E. P. P. Butterfield. Common about Wakefield (J. Hebden, Q.J.C., 1874, p. 5). Rothwell, not common (G. Roberts, Nat Monthly, Sept. 1887). Birkenshaw, Sept. 1888 ! G. Wingate. Holmfirth, Jan. 1885 ! H. E. Craven. Huddersfield, not common (J. Whitwham, Nat., May 1877). Conisborough, June 1873 ! Roche Abbey, April 1884 ! W.D.R. Rose Hill, Penistone, June 1889 ! South Anston, Aug. 1891, and Doncaster, July 1892, L. E. Adams.

York Mid W.—Abundant, Eavestone, near Ripon, March 1883 ! J. Ingleby. Reynard Ings, Ilkley, May 1882 ! Starbotton, May 1886 ! W.D.R. Grassington, Aug. 1882 ! H. T. Soppitt. Generally distributed about Harrogate, Ripley, Ribston, and Knaresbro' (Fitzgerald, J. of Conch., Jan. 1889). Birstwith, very common (F. T. Walker, Q.J.C., Jan. 1882). Pateley Bridge, common, Apl. 1883 ! W. Storey. Banks of Lindley Wood Reservoir, July 1885 ! and near Limley, Goyden Pot, May 1886 ! W.D.R. Airton, Sept. 1883, H. T. Soppitt. Lime hills, Roundhay ! W. Nelson. Barwick, 1881 ! H. Pollard. Thorpe Stapleton, Oct. 1876 ! H. Crowther. New Leeds ! and Headingley, near Leeds, July 1884 ! W. E. Clarke. Boston Spa and Tadcaster, F. G. Binnie, 1880. Bardsey, Sept. 1881 ! Thorner, Oct. 1876 ! H. Crowther. Hook Moor, July 1885 ! G. Roberts. Bolton Percy, July 1880 ! W. Nelson

York N.W.—Swinton, near Masham, Aug. 1900 ! W.D.R. Taiths Gill, Baugh Fell, Aug. 1902 ! W.D.R.

TYNE.

Durham—Durham, April 1884 ! Spa Wood, Dinsdale, 1887 ! Baker Hudson. Darlington, common in gardens (Longstaffe, Hist. Darl., 1854, p 371).

Northumberland S.—Museum Grounds, Newcastle, Aug. 1888 ! R. Howse.

Cheviotland—Dean above Akeld, May 1852 (G. Johnston, Berwick Proc., 1852).

LAKES.

Westmorland, etc.—Grange, April 1884 ! Coniston, Oct. 1886 ! W.D.R.

Cumberland—Stanwix and Wetheral, in cellars and woods (Miss Donald, Cumberland list, 1882, p. 56).

Isle of Man—Frequent (Forbes, Mal. Mon., 1838, p. 6). Port Erin, 1881, L. E. Adams. Peel, Aug. 1894 ! R. Cairns. Castletown and Douglas, Aug. 1894, F. Taylor.

SCOTLAND.

WEST LOWLANDS.

Kirkcudbright—Maxwelltown, Sept. 1890 ! W. Evans.

Ayr—Glen App, near Ballantrae, July 1884 ! Baker Hudson.

Renfrew—Frequent, Greenock, Sept. 1886 ! T. Scott. Shielhill Glen, Aug. 1886 ! W.D.R.

Lanark—Outhouses, Glasgow, Sept. 1887, J. E. Somerville.

EAST LOWLANDS.

Peebles—Walkerburn, Aug. 1886 ! W.D.R. Kingsmeadows, July 1890 ! W. Evans.

Selkirk—Thornielee railway station, Aug. 1886 ! W.D.R.

Roxburgh—Melrose Abbey, June 1886 ! J. Madison.

Berwick—Fans, near Earlston, Oct. 1883 ! R. Renton. Near Cockburnspath ! and about Eyemouth (W. Evans, Moll. Berwick, 1895, p. 170).

Haddington—Abandoned railway near Drummore, Aug. 1886 ! W.D.R. North Berwick (J. McMurtrie, J. of Conch., 1889, p. 3).

Edinburgh—Edinburgh, R. F. Scharff, 1883. Bonally, Sept. 1888, W. E. Clarke. Cramond Isle, Sept. 1888 ! T. Scott. Levenhall, near Musselburgh, 1886 ! W.D.R. Harmony, near Balerno, April 1890 ! W. Evans. Colinton, July 1889 ! W. Evans.

Fife & Kinross—Near Cupar, July 1886 ! T. Scott. *EAST HIGHLANDS.*

Stirling—Polmont, Aug. 1890 ! W. Evans.

Perth S.—Enumerated by G. McDougall, in Report Stirling Soc., June 1896.

Mid Perth—Annat Lodge, Perth, May 1886 ! H. Coates.

Forfar—Broughty Ferry, A. Somerville, 1886. Montrose, July 1884 ! W. Duncan.

Kincardine—Stonehaven (Macgillivray, Deeside and Braemar list, 1855, p. 418).

Aberdeen S.—Plentiful about Old Bridge of Don. Torry near Aberdeen (Macgillivray, Moll. Aberdeen, 1843). Plentiful by the Don and the Dee, at Nether Banchory (James Taylor, Zool., 1853, p. 3878).

Aberdeen N.—Plentiful, Auchterless, and near Inverugie Castle (Macgillivray, Deeside and Braemar list, 1855, p. 418).

Elgin—Common among trees near Waterton, Ellon (R. Dawson, Aberdeen, etc., list, 1870, p. 14). Elgin (specimens in McAndrew coll., J. of Conch., 1882, p. 385).

WEST HIGHLANDS.

Main Argyle—Lismore and wood behind railway station, Oban, Aug. 1893 (Standen & Hardy, J. of Conch., Oct. 1893).

Dumbarton—Common at Maryhill, by side of canal, July 1897 ! A. Shaw.

Clyde Isles—Rothesay, Bute, May 1887 ! T. Scott.

NORTH HIGHLANDS.

Sutherland E.—Golspie Burn, June 1886 ! and Brora, Apr. 1890 ! W. Baillie.

NORTHERN ISLES.

Orkneys—(T. S. Traill, Edinburgh Encycl., 1830, p. 10).

Shetland Isles—(Jeffreys, Ann. and Mag. N.H., Oct. 1868).

IRELAND.

Fairly common in most parts of Ireland, but the type form is not common in the north, the maculate varieties being the most prevalent.

ULSTER.

Derry—Coleraine, moderately common, 1883-4, L. E. Adams.

Antrim—Belfast (W. Thompson, Ann. and Mag. N.H., 1840, p. 198). Cushendun, May 1886 ! and Whitehall, Broughshane, June 1886 ! S. A. Brenan. Abundant by roadside coppice between Fairhead and Murlough, Sept. 1896 (R. Standen, Irish Nat., Jan. 1897). Knockagh Mount ; Greenisland ; Plantation Port at Kenbane, near Ballycastle ; Glenavy, May 1900, R. Welch.

Down—Belvoir Park, near Belfast, 1893 ; Donaghadee Churchyard, 1897 ; Ardglass, 1897 ; Ballynoe Marsh, Downpatrick, 1898 ; Sydenham House Grounds, 1898 ; and Castle Park, Hillsborough, 1899, R. Welch, May 1902.

Armagh—Armagh ! (J. of Conch., Oct. 1890).

Tyrone—Aughnacloy, Clogher Valley, Feb. 1898, R. Welch.

Donegal—Mossy stumps, Port Salon, May 1893 (R. Standen, J. of C., July 1893).
Cavan—Woods and lake shore. Killykeen, July 1896 (Welch, Irish Nat., July 1896).
Meath—Trim Churchyard, July 1900, R. Welch.

LEINSTER.

Dublin—Dublin (W. Thompson, Ann. and Mag. N.H., 1840, p. 198. Kingstown, May 1886! W. F. de Vismes Kane. On island of 'Ireland's Eye' at the 'Stags, near Howth, 1897, R. Welch. Raheny, Killakee, and Leeson Park, Dublin (Scharff, Slugs of Ireland, 1891).
Kildare—Straffan, 1884, J. E. Palmer.
Wicklow—Woodenbridge, March 1893 (Scharff, Irish Nat., April 1893).
Wexford—Kilmanock, Sept. 1888! G. Barrett-Hamilton.
Queen's Co.—La Bergerie (Rev. B. J. Clarke, Ann. and Mag. N.H., 1843).
Westmeath—Killynon, Sept. 1886! W. F. de Vismes Kane.

CONNAUGHT.

Sligo—Near Ballina, not so common as *L. arborum* and *L. agrestis* (Warren, Zool., 1879, p. 26). Rockwood, Lough Gill, Oct. 1886! Markree Castle, Collooney, Aug. 1886! W. F. de Vismes Kane.
Mayo W.—Enniscoe demesne, Crossmolina, Sept. 1885! W. F. de Vismes Kane. Moyview, Ballina, July 1891! Amy Warren. Erriff Valley and Aasleagh Falls, R. Welch, April 1897.
Galway E.—Clonbrock, June 1896 (R. F. Scharff, Irish Nat., Sept. 1896). Dernasliggan, April 1897 (R. Welch, Irish Nat., Nov. 1897).

MUNSTER.

Clare—Ballyvaughan, July 1895 (Standen, Irish Nat., Sept. 1895).
Cork N.—Youghal, 1835! Warren Collection, Dublin Museum.
Limerick—Limerick, W. H. Harvey (Thompson, Ann. and Mag. N.H., 1840, p. 198).
Tipperary S.—Clonmel, April 1888, A. H. Delap.
Waterford—Waterford, Sep. 1883! J. H. Salter.
Kerry—Valentia, July 1886! A. H. Delap; very large, near Lough Caragh, May 1891 (Scharff, Slugs of Ireland, 1891, p. 518). Stricken, G. P. Farran; Killowen Old Church, and at Kilmakilloge, Mr. Bigger; Torc Woods, G. W. Chaster (Standen, Irish Nat., Sept. 1898). Kenmare, Aug. 1899! J. E. Mason.

GERMANY.

In Germany it has been recorded for Altenburg, Alsace, Bavaria, Baden, East Friesland, Hesse, Hanover, Hamburg, Lorraine, Mark Brandenburg, Mecklenburg, Nassau, Osnabruck, Pomerania, Pyrmont, Prussia, Rhenish Prussia, Silesia, Thuringia, Upper Franconia, Weimar, and Wurtemburg.

NETHERLANDS.

Holland—(Heynemann, Jahr. Deutsch. Mal. Ges., 1885, p. 247).
Belgium—Chaudfontaine, Font de Forêt; Forest of Angre; Hastière, etc., etc.

FRANCE.

Probably diffused over the whole country, and has been recorded from the following districts and departments:—

Ain, Aisne, Allier, Ariège, Basses Pyrénées, Champagne Meridionale, Charente Inférieure, Côtes du Nord, Côte d'Or, Finistère, Gard, Gers, Haute Garonne, Haute Loire, Hautes Pyrénées, Haute Savoie, Hérault, Isère, Ille et Vilaine, Loire Inférieure, Lozère, Manche, Maine et Loire, Morbihan, Moselle, Nièvre, Nord, Oise, Pas de Calais, Puy-de-Dôme, Savoie, Seine et Marne, Seine, Seine Inférieure, Somme, Vendée, Vienne, Vosges, and according to Scharff is common at Ajaccio in Corsica.

SWITZERLAND.

Probably diffused through a large part of the country, and has been recorded for the cantons of Berne, Graubunden, Geneva, Lucerne, Neuchatel, Solothurn, Ticino, Uri, Vaud, Zurich, etc.

ITALY.

All Italy, continental and insular, except Sicily, where *L. unicolor* Heynemann is found (Lessona & Pollonera, Mon. Limac. Ital., 1882).

AUSTRO-HUNGARY.

In Austro-Hungary it has been observed in Austria, Bohemia, Galicia, Goritz, Lauenberg, Silesia, Styria, and the Sudetic Mountains, Transylvania, Tyrol, and Upper Hungary.

SPAIN AND PORTUGAL.

Spain—Aragon, Cataluña, Valencia (Graells, Moll. España, 1846, p. 1). Common in gardens at Fuente del Mar, near Santander, May 1860 (E. J. Lowe, Dec. 1896).
Portugal—Mountains of Cintra (Morelet, Moll. Port, 1845, p. 43).

GREECE.

Thessaly—Mount Pindus (Boettger, Jahrb. Deutsch. Mal. Ges., 1886). Isle of Santorin (Letourneaux, Bull. Soc. Mal. France, 1884, p. 290).

SCANDINAVIA.

Norway—Laurvik, near Christiania; Arendal and Island of Tromsó, near Christiansand, and at Bergen (Esmark, J. of Conch., Oct. 1886); recorded for Trondjhem, but probably in error, by G. O. Sars, Moll. Arct. Norv., 1878, p. 371.

Sweden—Stockholm (Hartmann & Heynemann, Jahr. Deutsch. Mal. Ges., 1885).

Denmark—Viborg in Jutland; Copenhagen and Fredricksberg in Zealand (Malm, Lim. Scand., 1868, p. 57).

RUSSIA.

Found in the provinces of Finland, Kurland, Livland, and Esthland, and at Sebastopol in the Crimea (Heynemann, Jahr. Deutsch. Mal. Ges., 1885); Moscow (Nadjeschin, Nacht. Deutsch. Mal. Ges., 1870); and in the provinces of Kharkov, Poltava, and Tchernigov (Kaleniczenko, Bull. Moscow, 1851).

Poland—Wood of Tuliszow, 1868; Ztoly-Potok, 1870; the park of Natolin, Olsztyn, 1873; Pulawy Kazimierz, 1874 (Slosarski, Moll. Pologne, 1877).

Transcaucasia—Imeretien (Heynemann, Jahrb. Deutsch. Mal. Ges., 1885).

NORTH AFRICA AND ASIA MINOR.

Algeria—Gardens near Algiers, May 1837 (Forbes, Ann. N.H., Dec. 1838, p. 251).

Asia Minor—El Bireh, Barrois (Dautzenberg, Moll. Palestine et Syrie, 1894).

ATLANTIC ISLES.

Azores—(Heynemann, l.c. 1885, p. 285).

Canaries—Plain of the Laguna, Teneriffe (Férussac, Hist., 1819, p. 71).

Madeira—(T. D. A. Cockerell, J. of Mal., May 1897, p. 4).

NEARCTIC REGION.

New York—Riverdale, H. Prime, 1885; New York City and Brooklyn (Binney, 1885). Cayuga Lake Valley (N. Banks, Nautilus, April 1892). Monroe Co., J. Walton, 1898.

Rhode Island—Newport, S. Powell (Binney, Proc. Acad. Nat. Sci. Phila., 1875). Providence, H. Prime, 1885.

New Jersey—Guttenberg, H. Prime, 1885.

Massachusetts—In City Aqueduct, Springfield (Pilsbry, Naut., Apl. 1883). New Bedford and Cambridge (Pilsbry, Proc. Acad. Nat. Sci. Philad., 1889).

Pennsylvania—Lincoln Park, Philadelphia (F. C. Baker, Nautilus, Sept. 1900). West Philadelphia and Danby, plentiful in cellars and greenhouses, H. A. Pilsbry; Wissahickon, uncommon; Laurel Hill cemetery, common; Germantown, E. G. Vanatta (M. Schick, Nautilus, April 1895).

Ohio—Cistern on Third street, Cincinnati, J. H. James, 1885.

Texas—New Braunfels (Pilsbry, Proc. Acad. Nat. Sci. Philad., 1889).

California—Gardens, San Diego (C. R. Orcutt, Nautilus, 1890). Abundant in San Francisco (W. M. Wood, Nautilus, July 1894). Dr. Stearns' garden, Los Angeles, summer 1901 (T. D. A. Cockerell, J. of Mal., Dec. 1901).

NEOTROPICAL REGION.

Mexico—City of Mexico, March 1894, Dr. A. Dugès (T. D. A. Cockerell, J. of Mal., June 1894).

ETHIOPIAN REGION.

Cape Colony—(Melvill & Ponsonby, Proc. Mal. Soc., Dec. 1898).

AUSTRALASIAN REGION.

New Zealand—Dunedin, F. W. Hutton (Musson, Proc. Linn. Soc. N.S.W., 1890).

Tasmania—Gardens and cellars at Hobart, R. Tate; and at Launceston, C. Hedley (Musson, Proc. Linn. Soc., N.S.W., 1890).

S. Australia—Adelaide (R. Tate, Rep. Roy. Soc. Tasmania, 1880).

Victoria—Ballarat, under logs in the bush, five miles from city (Musson, Proc. Linn. Soc. N.S.W., 1890).

New South Wales—Common in and around Sydney, J. Brazier (Musson, Proc. Linn. Soc. N.S.W., 1890).

Distribution of *Limax maximus* L.

In the Counties and Vice-Counties of the British Isles.

ENGLAND AND WALES.

Channel Isles

PENINSULA
1 Cornwall W.
2 Cornwall E.
3 Devon S.
4 Devon N.
5 Somerset S.
6 Somerset N.

CHANNEL
7 Wilts N.
8 Wilts S.
9 Dorset
10 Isle of Wight
11 Hants S.
12 Hants N.
13 Sussex W.
14 Sussex E.

THAMES
15 Kent E.
16 Kent W.
17 Surrey
18 Essex S.
19 Essex N.
20 Herts.
21 Middlesex
22 Berks.
23 Oxford
24 Bucks.

ANGLIA
25 Suffolk E.
26 Suffolk W.
27 Norfolk E.
28 Norfolk W.
29 Cambridge
30 Bedford
31 Hunts.
32 Northampton

SEVERN
33 Gloucester E.
34 Gloucester W.
35 Monmouth
36 Hereford
37 Worcester
38 Warwick
39 Stafford
40 Salop

SOUTH WALES
41 Glamorgan
42 Brecon
43 Radnor
44 Carmarthen
45 Pembroke
46 Cardigan

NORTH WALES
47 Montgomery
48 Merioneth
49 Carnarvon
50 Denbigh
51 Flint
52 Anglesey

TRENT
53 Lincoln S.
54 Lincoln N.
55 Leic. & Rutld.
56 Notts.
57 Derby

MERSEY
58 Cheshire
59 Lancashire S.
60 Lancashire Mid

HUMBER
61 S.E. York
62 N.E. York
63 S.W. York
64 Mid W. York
65 N.W. York

TYNE
66 Durham
67 Northumb. S.
68 Cheviotland

LAKES
69 Westmorland and L. Lancs.
70 Cumberland
71 Isle of Man

SCOTLAND.

W. LOWLANDS
72 Dumfries
73 Kirkcudbright
74 Wigtown
75 Ayr
76 Renfrew
77 Lanark

E. LOWLANDS
78 Peebles
79 Selkirk
80 Roxburgh
81 Berwick
82 Haddington
83 Edinburgh
84 Linlithgow

E. HIGHLANDS
85 Fife & Kinross
86 Stirling
87 Perth S. & Clkn
88 Mid Perth
89 Perth N.
90 Forfar
91 Kincardine
92 Aberdeen S.

E. HIGHLANDS
93 Aberdeen N.
94 Banff
95 Elgin
96 Easterness

W. HIGHLANDS
97 Westerness
98 Main Argyle
99 Dumbarton
100 Clyde Isles
101 Cantire
102 Ebudes S.
103 Ebudes Mid
104 Ebudes N.

N. HIGHLANDS
105 Ross W.
106 Ross E.
107 Sutherland E.
108 Sutherland W.
109 Caithness

NORTH ISLES
110 Hebrides
111 Orkneys
112 Shetlands

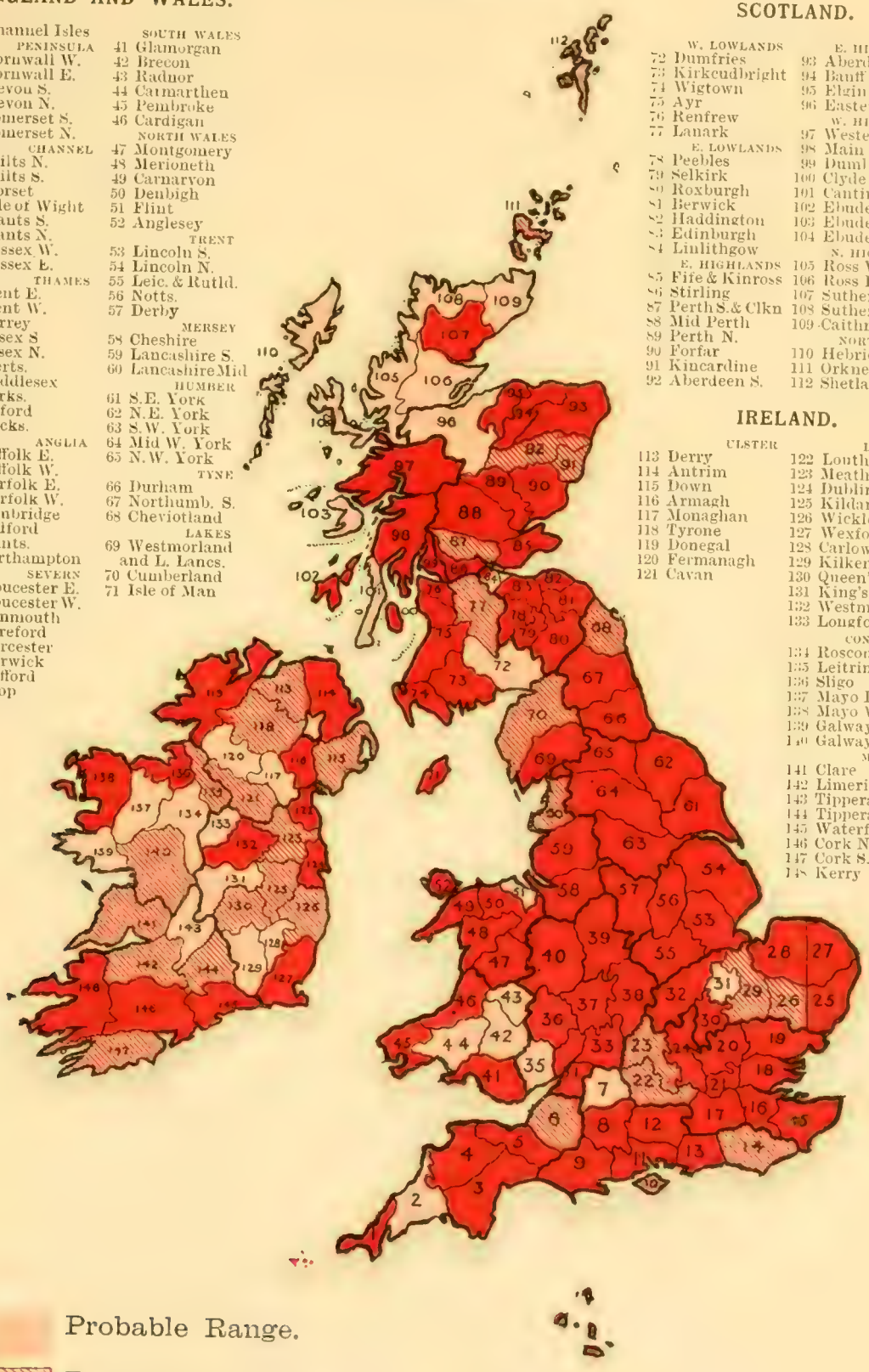
IRELAND.

ULSTER
113 Derry
114 Antrim
115 Down
116 Armagh
117 Monaghan
118 Tyrone
119 Donegal
120 Fermanagh
121 Cavan

LEINSTER
122 Louth
123 Meath
124 Dublin
125 Kildare
126 Wicklow
127 Wexford
128 Carlow
129 Kilkenny
130 Queen's Co.
131 King's Co.
132 Westmeath
133 Longford

CONNAUGHT
134 Roscommon
135 Leitrim
136 Sligo
137 Mayo E.
138 Mayo W.
139 Galway W.
140 Galway E.

MUNSTER
141 Clare
142 Limerick
143 Tipperary N.
144 Tipperary S.
145 Waterford
146 Cork N.
147 Cork S.
148 Kerry



Probable Range.

Recorded Distribution.

Distribution verified by the Authors.

Limax cinereo-niger Wolf.

1774 **Limax** *cinereus* varr. *a* and *e* Müller, Verm. Hist., ii., pp. 5 and 7.
1789 — *ater* Razoumowsky, Hist. Nat. Jorat, p. 266.
1803 — **cinereo-niger** Wolf, in Sturm's Deutsch. Fauna, fasc. 1.
1804 — *geographicus* Renier, Prodr. Classe d. Vermi Adriatico.
1819 — *antiquorum* Fér., Hist. Moll., p. 68, pl. iv., f. 1, pl. 8A, f. 1 & pl. 8D, f. 2.
1821 — *alpinus* Fér., Tabl. Syst., p. 21, pl. 4A, ff. 5-7.
1822 — *vittipes* Bonelli, MS., Mus. Taurin.
1836 — *maurus* Held, in Isis, p. 271.
1851 — *bilobatus* Ray & Drouet, Moll. Champagne, p. 16.
1852 — *lineatus* Dumont & Mortillet, Hist. Moll. Savoie, p. 192.
1854 — *dacampi* Menegazzi, Malac. Veronese, p. 63, pl. 1, ff. 1-4.
1855 — *corsicus* Moquin-Tandon, Hist. Moll. France, ii., p. 26, pl. 3, ff. 10-13.
1855 — *claravallensis* Drouet, t. Moquin-Tandon, op. cit., p. 28.
1861 — *doriæ* Bourg., Rev. et Mag. Zool., p. 256, pl. 8, ff. 1-11.
1862 — *engadinensis* Heyn., Mal. Bl., p. 204.
1862 — *transilvanica* Heyn., Mal. Bl., p. 216.
1863 — *nubigenus* Bourg., Spic. Mal., p. 20.
1864 — *erythrus* Bourg., Mal. Grande Chartreuse, p. 31, pl. 2, ff. 1-8.
1867 — *niger* Malzine, Faune Mal. Belgique.
1871 — *montanus* Leydig, Verhandl. Wurtt., p. 210.
1873 — *bielzii* Seibert, Mal. Bl., p. 195.
1881 — *cinereus β intermedia* Brevière, J. de Conch., p. 314.
1894 — *hedleyi* Collinge, Journ. of Mal., iii., pp. 51, 52, and iv., pp. 4, 5, 1895.
1849 *Arion lineatus* Dumont, Bull. Soc. Hist. Nat. Savoie, p. 64.
1868 *Eulimax cinereo-niger* Malm, Skand. Limac., p. 57, pl. 5, ff. 12, 13.
1876 *Limacella cinereo-niger* Jousseaume, Bull. Soc. Zool. France, p. 99.

HISTORY.—*Limax cinereo-niger* (*cinereo-niger*, ashy-black), is one of the largest and most brilliantly coloured of the European slugs, if the allocation by Simroth of the gorgeous Italian forms to this species be correct, the colouration of these magnificent Limaces ranging from black to white, through vivid red, bright yellow, grey or brown, and in size far exceeding the largest *L. maximus*. In the cool and moist climate of the British Isles, however, this species is unusually constant in its colouring, and offers little variation from a more or less uniformly dark pigmentation.

With this, the finest species of the group, we associate Herr D. F. Heynemann, of Frankfort, whose services to the cause of Limacology can scarcely be overestimated, and in recognition of whose labours Malm constituted the group *Heynemannia* to embrace the present species and its close allies.

Although, in common with Dr. Simroth and many other malacologists, Herr Heynemann regards *Limax cinereo-niger* as only a form of *Limax maximus*, "changed by food, climate, or anything else," it is possible that this belief is in many cases based upon a pre-conceived opinion, which an accurate appreciation of the undoubted differences would probably modify, as, though both species have certainly sprung from the same stemma, *cinereo-niger* is undeniably the more ancient offshoot, exhibiting such an assemblage of divergent characters as seems conclusively to show that it has finally parted company with *L. maximus*.

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The *Limax ater* and related forms are in all likelihood the more primitive forms of this species in which the dark colouring of the body has not yet spread to the side areas of the sole, but in the absence of the possibility of a precise determination, Wolf's name has been adopted for the species in preference to that of Razoumowsky.

The type form characterized by Wolf has the ground colour white, as is evidenced by the keel and mid-dorsal line retaining that colour, while the remainder of the animal is almost wholly black, due to the diffusion of the black markings.

The *Limax dacampi* var. *amaliæ* of Bettoni is identical with the type, while *Limax hedleyi* Collinge and *L. maximus* var. *luctuosa* only differ in the white mid-dorsal line being sullied with a slight ochraceous tint and not extending quite up to the shield.

Diagnosis.—EXTERNALLY, *L. cinereo-niger* in its typical form is distinguished from *L. maximus* by its more uniformly dark colouring, its shorter and stouter tentacles, its coarse and prominent rugæ, and its sharp and well-marked keel, which usually extends fully half the length of the body, and sometimes is perceptible quite to the shield. The shield is typically unicolorous, and the sole distinctly longitudinally tripartite, the outer areas being black or deep ash-grey and the mid-area paler.

INTERNALLY, the shell is thin and brittle, almost transparent when fresh, broad and comparatively short; the penis-sheath is of tolerably equal width throughout, not enlarged and stiffly flexed at the free-end as in *L. maximus*, while its retractor arises, according to Dr. Scharff, between the heart and the kidney as in *L. flavus*, and not behind the kidney as in *L. maximus*; the lingual teeth are broader and also markedly more cuspidate and embryonic in their character; the mandible is smaller and more delicate, the median beak is not so prominent, and the lower outer margins are distinctly rounded and not rectangular as in *L. maximus*.

In habits, *Limax cinereo-niger* is more active and less nocturnal than *L. maximus*, it has a wider range, both altitudinally and geographically, and is not so partial to the vicinity of human dwellings.

Description.—ANIMAL with a long and rounded but stouter body than *Limax maximus*, varying in length from 100 or more mill. to, in extreme cases, 400 mill.; GROUND COLOUR usually whitish in this country, but in southern Europe often of a vivid red or other bright colour, banded, maculated, or washed-over with grey, brown or black, and very frequently, more especially in the colder and moister districts, of an uniform black; the whole surface covered with large, boldly projecting sinuous tubercles, reminiscent of those of *Arion ater*; the caudal end of the body bears a strongly developed and very prominent KEEL, which is sometimes perceptible quite to the shield; NECK paler, with a pair of longitudinal DORSAL FURROWS, which terminate in front as the FACIAL GROOVES; SOLE[1] longitudinally tripartite, the inner area pale, the two outer areas dark with sharply defined margins, except in the young stages or where from any cause the juvenile or primitive trait of an unicolorous sole is preserved to adult life; SHIELD large, oblong, nearly two-fifths the total length of the animal, rounded in front and more sharply angulated behind, usually of an uniform black or darkish tint, but in the young or in those adults which have retained immature colouring may be marbled or spotted with some darker colour or black upon a pale ground. MUCUS colourless and iridescent, or as in certain of the more extreme varieties, a red pigment may break through the skin and tinge the slime.

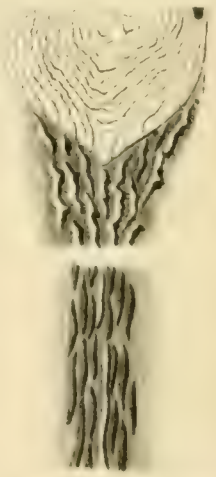


FIG. 70.—Pallial and body sculpture of *Limax cinereo-niger* Wolf (after Lessona).

1 Monog. i., 194, f. 383.

SHELL situated beneath the hinder part of the shield; somewhat quadrately oval, resembling in size and shape that of *Limax flavus*; thin, brittle, and almost transparent when fresh, whitish, slightly concave beneath, with lines of concentric increase, and a broad, brownish membranaceous fringe; APEX or nucleus near to the left posterior angle. Length, 8½ mill.; breadth, 6 mill.

FIG. 71. — Internal shell of *L. cinereo-niger* × 1½.
(Brora, E. Sutherland, Mr. W. Baillie).

INTERNALLY, the organization of *Limax cinereo-niger* resembles in general character that of *L. maximus*, but in many points shows distinct evidences of an earlier type of structure. The SENSORY ORGANS though doubtless closely resembling those of the congeneric species, have never been critically studied in comparison with those of *Limax maximus*.

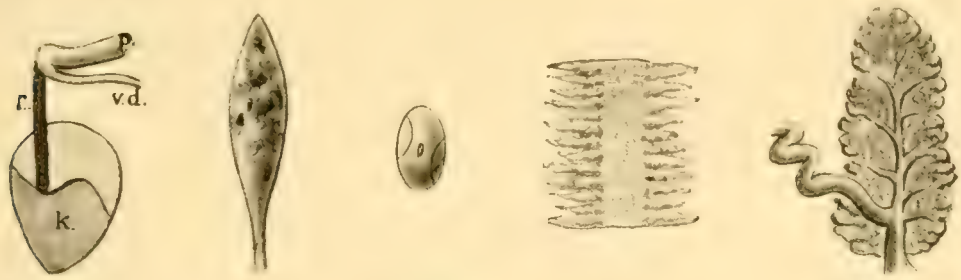


FIG. 72. FIG. 73. FIG. 74. FIG. 75. FIG. 76.

DETAILS OF THE INTERNAL STRUCTURE OF *Limax cinereo-niger* Wolf.

FIG. 72.—Distal end of penis sheath, shewing the position of the dorsal attachment of retractor (after Scharff). *k.* kidney; *p.* penis sheath; *r.* retractor; *v.d.* vas deferens. FIG. 73.—Spermatheca or receptaculum seminis × 2. FIG. 74.—Otolith (after Schmidt), highly magnified. FIG. 75.—Prostatic or sperm duct, shewing its follicular structure × 4. FIG. 76.—Albumen gland and hermaphrodite duct × 2.

The REPRODUCTIVE ORGANS, though similar to those of its close ally, yet exhibit constant differences; they show a larger and more deeply coloured OVOTESTIS which occupies the caudal end of the body to the exclusion of other organs; the HERMAPHRODITE DUCT is of a clear bluish-white, and without any apparent VESICULA SEMINALIS; ALBUMEN GLAND of an ochreous colour and usually smaller than the ovotestis; OVISPERMATODUCT narrow, the creamy-white prostate usually wider than the oviduct; FREE-OVIDUCT short, thick, and doubly flexed near the base; SPERMATHECA fusiform, mottled with reddish-amber and opaque ochreous-white and fixed by its crown to side of oviduct, the stem clear azure-white, about half the length of the vesicle; PENIS-SHEATH greyish-white, very long, and nearly uniformly cylindrical or vermiform for its whole length, not distally swollen and rigidly flexed as in *Limax maximus*, with the clear-bluish-white VAS DEFERENS entering terminally; the RETRACTOR MUSCLE is long, broad, and ribbon-like, attached to the extremity of the penis-sheath and to the dorsum between the heart and the kidney, in a sinus of which the heart is situated.

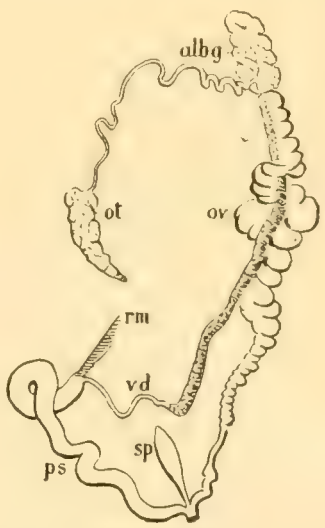


FIG. 77.—Sexual organs of *L. cinereo-niger* Wolf.
(Oswestry, Salop, Mr. Baker Hudson).
alb.g. albumen gland; *ov.* oviduct; *ot.* ovotestis; *p.s.* penis; *r.m.* retractor; *sp.* spermatheca; *v.d.* vas deferens.

The ALIMENTARY CANAL shows a short ŒSOPHAGUS opening into a large, oval, and brownish CROP; SALIVARY GLANDS united at base and not easily separated from the walls of the crop; beyond the crop the canal narrows considerably, widening again at the stomach at the termination of the first alimentary tract, where two or three bile ducts enter from as many lobes of the reddish-brown LIVER or DIGESTIVE GLAND; the INGESTIVE or STOMACH TRACT also does not show the extreme development posteriorly which is so marked a feature in the fully adult examples of *Limax maximus*.

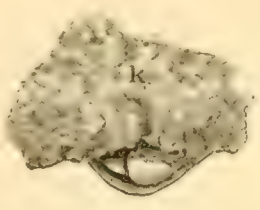


FIG. 78.—Kidney or renal organ and heart of *L. cinereo-niger*, ×2. *k.* kidney.

Mandible or jaw smaller and weaker than in *Limax maximus*, of a pale amber colour, with usually two dark submarginal parallel thickenings near the upper margin ; the median beak projects somewhat beyond the line of jaw, but is not nearly so convex or so prominent as in *L. maximus*, and the lower outer angles of the jaw, so abruptly angulated and almost rectangular in *L. maximus*, are in the present species obliterated by the convexity connecting the upper and lower margins, the ends having to some extent the somewhat horned aspect distinguishing the mandible of *Hyalinia helvetica*.

Fig. 79.—Mandible or jaw of *Limax cinereo-niger* Wolf × 8. (Goyt Valley, Cheshire, Mr. C. Oldham).

The lingual membrane of a Cheshire specimen is eight mill. long, and three mill. or more in breadth, covered with slightly curved transverse rows of teeth which are very uniform in size, only diminishing at the margins ; median row with a somewhat hour-glass shaped base, similar to that of *L. maximus*, and bearing a broad reflection with obsolete side reflections and a strong mesoconic prolongation bearing trifid cutting points ; lateral teeth trifid, with strong mesocone, distinct endocone, and a less prominent ectocone, which in the succeeding teeth becomes more distinct,

Fig. 80.—Representative denticles from a transverse row of the lingual teeth of *L. cinereo-niger* Wolf ×120. The animal collected by Mr. C. Oldham at Whaley Bridge ; the radula prepared by Mr. W. Moss, and photographed by Mr. T. W. Thornton.

though always more basal than the endocone ; about the twentieth row, the teeth, though still trifid, become more aculeate in character, and about the thirtieth row the endocone becomes obsolete, the ectocone and mesocone only being retained to the margins of the membrane, although a few trifid teeth may sometimes be seen, due, however, to the retention from the embryonic state of a secondary ectocone.

The dental formula of a Whaley Bridge specimen, collected by Mr. C. Oldham, is

$$\frac{44+30+1+30+44}{2\quad 3\quad 3\quad 3\quad 2} \times 168 = 25{,}032.$$

Reproduction and Development.—Pairing would appear to take place throughout the milder periods of the year, and is always preceded by the same amatory preludes and prolonged circular procession described under *Limax maximus*, but during the act of congress the animals do not invariably suspend themselves by a long conjointly secreted mucus cable, as in that species, but remain firmly attached to the underside of the branch or other object by the greater part of the sole, leaving free only the anterior part of the body to become entwined with that of their partner.

The general character of the conjugation is, therefore, similar in the two species, although there are no precise modern observations available for comparison of the details of the act.

The ova are deposited in moist places beneath the shelter of fallen trees, under loose bark, or other suitable situations, those of the var. *corsica* being described by Moquin-Tandon as globular in shape, and about five mill. in diameter, shining, transparent, about the colour of gum-arabic, and united together in little clusters, and are said to hatch in about a month's time.

According to Lessona & Pollonera, the young when hatched have the shield mottled with black and white, and the foot-sole pale and unicolorous, but as growth proceeds, the pale markings on the shield become clouded over by the diffusion from the centre of the dark markings, which gradually extend towards the margins, which are also eventually darkened over, except in some adults which may retain traces of the pale maculations of their early life, but these vestiges are always more especially displayed towards the margins.

The lateral zones of the sole are also little by little invaded by the dark tint, until they acquire their full depth of colouring, or as in the case of the dark colouring of the shield, the process of pigmentation may be arrested or retarded, and examples may therefore be found, especially at or near the

limits of its altitudinal or latitudinal range, which retain at maturity, in a more or less pronounced form, their juvenile stage of colouring.

The variegated and banded varieties may thus be regarded as having retained to adult life the youthful garb of the species, and as being the intermediate stage leading to the dark unicolorous forms which are the most advanced in their external colour evolution.

Every district, however, has a local facies, which will be more or less in harmony with the geographical position of the locality and the peculiarities of the environment. Herr Goldfuss records that in Westphalia the young of this species are of an uniformly dark-grey; Dr. Simroth, writing chiefly of the species as found near Leipzig, describes the very young examples as usually pale, washed over with carmine-red, and the sharply defined main-band of the body as extending upon the shield, while Dr. Boettger, presumably describing those of Frankfort, says the foot-sole in the young is always trifasciate, and the body zoned with four longitudinal dark bands, with the keel of a yellowish colour, but as maturity is attained the body becomes wholly black, though sometimes retaining the yellow keel.

Mr. Roebuck's extensive experience of British specimens supports the view that the young possess an uniformly pale foot-sole, and that the side-areas are progressively invaded by the dark pigmentation as the animals increase in age.

The life term, according to Dr. Simroth, is about one year, but there is little doubt that under favourable circumstances that period would be greatly exceeded.

Food.—*Limax cinereo-niger* in a state of nature is considered to be a great and almost exclusive feeder upon fungi and other cryptogamic plants, and is recorded as greedily devouring *Peziza macrocalyx*, *P. vesiculosa*, *Morchella esculenta*, *Evernia prunastri*, etc.

Stahl records that the food of all the specimens of this species examined by him in the month of June was apparently solely fungi, as the excrementitious matter was composed of partially digested hyphæ and undigested spores of *Peziza macrocalyx*.

In captivity or under the pressure of hunger they will, however, eat bread and many other kinds of food.

Habits.—This species is less nocturnal and more active in habit than *Limax maximus*, and is always abroad during the day in damp, moderately warm weather. It frequents pine and other forests, more especially in shady places, hiding beneath the bark of dead trees, or on fungus-covered stumps, but is also often found under logs, or among dead leaves in the woods, and other similar retreats.

In Italy and other south European countries it lives chiefly in the mountain forests, the darker varieties being found at the higher altitudes, while the more brightly-coloured forms are restricted to lower ground; thus, the var. *maura* is found on Monte Mucrone, in Piedmont, at an altitude of 2,200 metres (about 7,200 feet), and the sub-var. *nubigena* reaches nearly to the verge of eternal snow on Maladetta in the Pyrenees, while the brightly-coloured var. *dacampi* has its most elevated station at Prestine, in the Valle dell' Oglio, in Lombardy, at 800 metres above sea level (about 2,620 feet), and the still more brilliant var. *corsica* is even more restricted in its altitudinal range, its highest-known habitat in the mountains of Liguria not exceeding 700 metres (about 2,290 feet).

In this country this species is also chiefly found in hilly or wooded districts and usually at some distance from dwelling-houses.

The OLFACTORY sense in *L. cinereo-niger* is remarkable for its power and precision. M. Colbeau relates that the fine specimen of var. *malacologorum* in his possession escaped many times from the box in which it was confined, through a small hole five mill. in diameter, and after wandering about several days in the garden, on two occasions re-entered the box by the same small hole, evidently attracted by the mushrooms grown therein.

Variation.—Colour variation in the Limacidæ would seem to reach its acme of development in this species, individuals of which display all shades of colour, ranging from uniform white, through grey, yellow, brown, and red to uniform black, with all the variations to which their combinations may give rise. This marvellous variety in colour and marking leads us to suspect, as suggested by Simroth, that this rich and elaborate pigmentation is of high biological importance to this species in the struggle for existence.

The complex causes which influence or inhibit the evolution and external disposition of colouring matter in the Limacidæ are still little understood: it has, however, been demonstrated by Simroth that the intensity and shade of the various colourings are dependent in a measure upon temperature, especially during the growth period. Cold, inclement seasons or districts favour the increase of the black pigment, and pale or entirely eradicate the red, while warm seasons or areas foster the development and intensification of the red pigment, resulting in the gorgeous varieties recorded from Italy and other southern countries; but it must not be overlooked that the distribution and character of the external pigmentation is also largely influenced by the necessities of the animal, either by inducing a closer assimilation to the peculiarities of the environment, and therefore a more effective concealment from its enemies, or conversely by the development of a brighter colouring, rendering it more conspicuous, and therefore probably acting as a warning colour.[1]

Like its close ally *Limax maximus*, the present species may also be regarded as trichroic or triple-tinted in its pigmentation, and has probably passed through a similar course of colour-changes, but the colour-development has advanced much further, a response to the more freely exposed life it leads and the consequent greater vicissitudes of temperature, etc., to which it is subjected.

The probable sequence of its pigmentary evolution is shown by the primary or secondary tints sometimes extending over the locomotor or mid-area of the sole, beyond the darker tertiary colouring which has not yet advanced beyond the side areas and is still very superficial in its disposition: further evidence of the progress of colour evolution is adduced by Simroth, from which we gather that in the youthful stages of the species in the more advanced districts there is a prevalence of the simple colouring which characterizes adults in those less favourable or more remote, as in *L. montanus* of South Tyrol, *L. engadinensis* of East Switzerland, etc.

L. cinereo-niger, judged by its more extended range altitudinally and also geographically wherever sufficient and precise observations have been made, by the situations it usually inhabits, by the more primitive character of its teeth, by the point of attachment of the penial retractor, and other peculiarities, is probably a more primitive and earlier form than *L. maximus*, but the extreme climatic conditions under which the species lives, have enabled it to outstrip in its external pigmentation the *L. maximus*, which evinces such a partiality for the vicinity of human abodes, and is therefore more prone to be carried by commerce to, and become naturalized in distant lands.

1 Monog., i., p. 327 and p. 330.

The numerous modifications discriminated by various authors have, for convenience of study, been grouped into several sections, based upon the fundamental colour of the body, those varieties which have retained to a marked degree in adult life the immature character of their colouring being regarded as sub-varieties.

FUNDAMENTAL BODY-COLOUR WHITE.

Var. **pallescens** Dum. & Mort., Mal. Savoie, 1857, p. 13.

Limax lineatus var. *pallescens* Dum. & Mort., op. cit.
Limax cinereo-niger var. *albicans* Malm, Skand. Limac., 1868, p. 61, pl. 5, f. 13.
Limax cinereo-niger var. *isseli* Pini, Moll. Esino, 1876, p. 26, pl. A, ff. 4, 5.
Limax albus Paasch, Archiv f. Naturg., 1843, p. 85.
Limax cinereo-niger var. *hareri* Heyn., Mal. Bl., 1862, p. 141.

ANIMAL white or whitish, with or without darkly tinted side-areas to the sole.

Dumont & Mortillet remark that this form is found in very shady places.

The form named by Heynemann, **hareri**, is pure white; **L. cinereo-niger** var. **albicans** and **L. lineatus** var. **pallescens** are whitish; while **L. cinereo-niger** var. **isseli** has the body whitish and a white keel.

Not hitherto recorded from the British Isles.

Germany—An albine form, from Hohen-Wittlingen, Swabian Alps (Weinland, Nachrichtbl, 1874, p. 42). Sub-var. *hareri*, in the Taunus Mountains, June 1861 (Heynemann, op. cit.).

France—Haute Savoie (Dumont & Mortillet, op. cit.).

Italy—Sub-var. *isseli*, Esino Valley, near Vezio in Lombardy (Pini, op. cit.).

Sweden—Sub-var. *albicans*, common on Bornholm; and has also been found near Ljungskile, and on the Alingsas tract (Malm, op. cit.).

Norway—Sub-var. *alba*, Bamble, Christiansand Stift (Esmark, J. of C., 1886, p. 100).

Var. **strobeli** Lessona, Moll. Piemonte, 1880, p. 21.

Limax cinereo-niger ζ *strobeli* Lessona, op. cit.

KEEL and median-line whitish, sides of body ash-coloured but showing the white ground colour as a series of whitish maculations with a single black band on each side, broken up into a row of spots; SHIELD ash-coloured. Formula 001 100.

Not hitherto recorded for the British Isles.

Italy—Maccugnaga, Val Anzasca, Piedmont, at an altitude of 1,323 metres (about 4,340 feet) (Lessona & Pollonera, Mon. Limac. Ital., 1882, p. 30).

Var. **vera** Dumont & Mortillet, Mal. Sav., 1857, p. 13.

Limax antiquorum var. β Ferussac, Hist. Moll., 1819, p. 68, pl. 4, f. 1.
Limax antiquorum v. *ferrussackii* Kaleniczenko, Bull. Soc. Imp. Mosc., 1851, p. 120.
Limax lineatus var. *verus* Dumont & Mortillet, op. cit.
Limax lineatus var. *interruptus* Dumont & Mortillet, op. cit.
Limax cinereo-niger var. *albicans, cinereo-nebulosus* Malm, Skand. Limac., 1868, p. 60.
Limax cinereo-niger η *stabilei* Lessona, Moll. Piemonte, 1880, p. 21.

KEEL whitish, two dark zones on each side of the body. Formula 021 120.

The *Limax antiquorum* var. β of Ferussac, though usually referred to as uniformly cinereous, is according to the figure distinctly quadrifasciate, with paler nebulous markings around the margin of the shield, and therefore belongs to this form. The reference by Kaleniczenko to Ferussac, Hist. Moll., pl. 4, f. 1, would seem, though not with certainty, to place his variety under this head.

The var. **vera** s.st. has the two black bands on each side and a dark shield.

The sub-var. **interrupta** differs in the lateral bands being interrupted.

The sub-var. **cinereo-nebulosa** has the keel tinged with yellowish, shield yellowish clouded with grey, sides of body whitish clouded with grey, lateral zones resolved into series of pale brown spots.

The sub-var. **stabilei** has the keel yellowish, the back blackish, and sides paler.

Oxford—Sub-var. *vera*, a young specimen from Oxford in the British Museum, presented by the Rev. A. M. Norman.

Germany—Heynemann records a sub-variety from Rastadt in Baden, with two rows of squarish black spots at each side, upon a white ground (Mal. Bl., 1862, p. 99).

France—Sub-vars. *vera* and *interrupta*, Haute Savoie (Dum. & Mort., op. cit.).

Italy—Sub-var. *stabilei* found in Piedmontese Alps by Stabile (Lessona, op. cit.).

Sweden—Sub-var. *cinereo-nebulosa* at Ljungskile (Malm, op. cit.).

Norway—Sub-var. *cinereo-nebulosa* at Malmons, Laurvik, and Skien (Esmark, J. of Conch., Oct. 1886, p. 100).

Russia—Sub-var. *ferrussackii* Kal., Tchernigov and Poltava (Kalen., op. cit.).

Var. **renardii** Kaleniez., Bull. Soc. Imp. Nat. Mosc., 1851, p. 120, pl. iv., f. 2.

Limax antiquorum Renardii Kal., op. cit.
Limax subalpinus Lessona, Moll. Piemonte, 1880, p. 18, pl. 2, ff. 1-6.
Limax subalpinus γ *simplex* Lessona & Pollonera, Monog. Limac. Ital., 1882, p. 36.
Limax subalpinus α *garocelus* Lessona & Pollonera, op. cit.
Limax subalpinus δ *veronensis* Less. & Poll., op. cit.
Limax maximus var. *tschapecki* Simroth, Nacht. Mal. Ges., 1886, p. 69.

Keel and mid-dorsal zone whitish, body with three dark zones on each side. Formula 321 123. The *L. subalpinus* Lessona and subsidiary forms differ chiefly in the retention by adults of the maculate mantle of the juvenile stage.

The var. **renardii** sensu stricto, has the sides of the body ashy-black, the inner and main bands black and continuous, outer band represented by a series of black spots; a white zone between the inner and main bands; shield ash-coloured.

The sub-var. **tschapecki** is somewhat variable, but has the white keel extending quite up to the shield; sides of body whitish with continuous main-band and indefinite inner and outer bands; shield speckled black and white.

The sub-var. **subalpina** has the whitish keel continued to the shield as a series of dorsal spots; sides of the body whitish, with three brownish-grey zones on each side which blend together and leave two rows of whitish spots between them.

The sub-var. **simplex** is similar, but the back is unicolorous.

The sub-var. **garocela** has the keel and dorsal-zone maculate with black, sides of the body whitish, maculate with black.

The sub-var. **veronensis** has the sides of the body and shield of an olivaceous ash-colour, the shield and body maculate or longitudinally banded with fuscous.

Not hitherto found in the British Isles.

Italy—The var. *subalpina* has been found in various localities in Piedmont, attaining its greatest altitude at Usseglio, Valle di Lanzo, 1,252 metres (about 4,100 feet); it has also been found at Rivarossa, Rivoli, Avigliana, Sacra di S. Michele, Hill of S. Giovanni, and the Hills of Turin. The sub-var. *simplex* is found at Rivoli and Avigliana. The sub-var. *garocela* on the Hill of S. Giovanni in the Valle di Viù, and has been doubtfully recorded by De Betta from Venetia. The sub-var. *veronensis* is recorded for Verona in Venetia by De Betta (Lessona & Pollonera, op. cit.).

Austro-Hungary—The sub-v. *tschapecki*, Styria and Carniola (Clessin, Moll., 1887).

Russia—The var. *renardii* was found in moist places and shady woods, near Sumy, Kharkov, in Aug. 1831 (Kaleniczenko, op. cit.).

Var. **ornata** Lessona, Moll. Piemonte, 1880, p. 21.

Limax cinereo-niger ε *ornatus* Lessona, op. cit.

Keel and dorsal zone white, a series of white maculations on each side of the body, which is black. Formula (32)1 1(23).

Sussex W.—Up Park, Aug. 1888! with type, W. Jeffery.

Italy—In Piedmont, at Alagna, Val Sesia, and at Maccugnaga in Val Anzasca, at an altitude of 1,323 metres (about 4,340 feet) (Less. & Poll., op. cit., p. 30).

Var. **cinereo-nigra** Wolf sensu stricto.

Limax antiquorum var. α Fer., Hist. Moll., 1819, pl. 8b, f. 2.
Arion lineatus Dumont, Bull. Soc. Hist. Nat. Savoie, 1849, p. 61.
Limax antiquorum razoumowskii Kaleniczenko, Bull. Mosc., 1851, p. 120.
Limax lineatus Dum. & Mort., Hist. Moll. Sav., 1852, p. 12.
Limax maximus ν *luctuosus* Moquin-Tandon, Hist. Moll. France, 1855, ii., p. 29.
Limax nubigenus Bourg., Spic. Mal., 1863, p. 20.
Limax dacampi var. *amaliæ* Bettoni, Bull. Mal. Ital., 1870, iii., p. 166, pl. 3, ff. 2, 2a.
Limax cinereo-niger γ *camerani* Less. & Poll., Mon. Lim. Ital., 1882, p. 29.
Limax cinereus β *intermedia* Brevière, J. de Conch., 1881, p. 314.
Limax hedleyi Collinge, J. of Mal., 1891, p. 51.

Keel and mid-line white; shield and sides of body black. Formula (321) (123).

The *Arion lineatus* of Dumont, the *Limax dacampi* var. *amaliæ* of Bettoni, *Limax antiquorum* α of Ferussac, *Limax maximus* μ *cinereo-niger* of Moquin-Tandon, *Limax bilobatus* of Ray & Drouet, and *Limax claravallensis* of Drouet appear to be strictly synonymous with the type-form of *cinereo-niger*.

The sub-var. **nubigena** has the white keel line extending only one-third the length of the body, the neck of yellowish-ash colour, and is a dwarfed or stunted form.

The sub-vars. **razoumowskii** and **luctuosa** only differ from typical *cinereo-niger* in the keel and dorsal-line being sullied by a yellowish shade, and by only extending to half the length of the body in *luctuosa*.

The sub-var. **intermedia** has the keel and mid-line whitish, and shield and sides of the body deep grey or brown.

The sub-var. **camerani** only differs from the sub-var. *intermedia* in the fuscous-chestnut colour of the shield and body.

The sub-var. **hedleyi** has the keel and mid-line pale or yellowish-brown, slightly interrupted anteriorly, the sides of the body chocolate-black, the ventral edges of the mantle dirty-white with irregular sepia dashes.

Warwick—Sub-var. *luctuosa*, Sutton Park, July 1899! H. Overton.

Glamorgan—Sub-var. *luctuosa*, Bridgend, July 1891! G. K. Gude.

Stafford—Sub-var. *luctuosa*, Shelbrook, Cannock Chase, June 1886! L. E. Adams.

York N.E.—Sub-var. *luctuosa*, Wass Bank, Hambleton escarpment, 800 feet altitude, Sept. 1892! and Mill Beck, Robin Hood's Bay, June 1888! W.D.R.

York S.W.—Sub-var. *luctuosa*, Skelmanthorpe, May 1897! F. Lawton.

York Mid W.—Sub-var. *luctuosa*, Shipley Glen, Oct. 1883! W. West.

York N.W.—Sub-var. *luctuosa*, Helm Ghyll, Dentdale, May 1899! J. E. Crowther.

Cheshire—Sub-var. *luctuosa*, Goyt Valley, Sept. 1902! C. Oldham.

Edinburgh—Sub-var. *luctuosa*, Roslin Woods, April 1898! W. Evans.

Derry—Sub-var. *hedleyi*, Rathmullan and Walworth, J. N. Milne (Collinge, J. of Mal., 1894, p. 51, and 1895, p. 4).

Germany—Sub-var. *luctuosa*, Alsace (Meyer, Nachtbl., 1876, p. 106). Specimens in British Museum, labelled Heidelberg, Baden, J. E. Daniels.

France—Sub-var. *luctuosa* in the Vosges, the Jura, and Dauphiné (Bourguignat, Mal. Grande-Chartreuse, 1862, p. 32); Grande-Chartreuse in the Isère (Moquin-Tandon, op. cit.). The sub-var. *nubigena* in the high mountains near the zone of pines, especially in the Forest of Superbagnères, Hautes Pyrenees (Bourg., op. cit.). The sub-var. *intermedia*, communal forest of St. Saulge, Nièvre (Brevière, op. cit.).

Switzerland—Sub-var. *luctuosa*, Canton Valais (Simon & Böttger, Nachtbl., 1885, p. 55).

Italy—This, the typical form, is found in the Alps of Lombardy and Piedmont, descending also to the valleys; it reaches its highest known habitat in Lombardy on Mont Cenis, at an elevation of 2,000 metres (about 6,555 feet); it was also found at Lambrate, Milan, by Bettoni. It has been recorded from Val della Dora Riparia, from Rivoli, from the Hills of Turin, and from between Calasca and Pestarena in the Val Anzasca in Piedmont; and from Vallombrosa, Tuscany. The sub-var. *camerani* is found in Piedmont at Maccugnaga, Val Anzasca, at an altitude of 1,323 metres (about 4,340 feet). The sub-var. *luctuosa* at Alagna in Val Sesia, Maccugnaga in Val Anzasca, Rivoli, and on the Hill of Turin (Lessona & Pollonera, op. cit.).

Austro-Hungary—Sub-var. *luctuosa*, Carlsbad (Böttger, Nachtbl., 1885, p. 56).

Spain—The sub-var. *nubigena* is found on the verge of perpetual snow on Maladetta, near the Cirque of the Rencluze in Catalonia (Bourguignat, op. cit.); and in the Valle del Essera in Aragon (Fagot, Mal. Catal., 1884).

Sweden—Sub-var. *intermedia*, Ringerige, July 1868 (Malm, op. cit., p. 88).

Russia—Sub-var. *razoumowskii* at Konotop, Borozdna, and Nejin, in Tchernigov (Kaleniczenko, op. cit.).

Var. **maura** Held, Isis, 1836, p. 271.

Limax maximus ξ *niger* Moquin-Tandon, Hist. Moll. France, 1855, ii., p. 29.
Limax maurus Held, in Isis, 1836, p. 271.
Limax lineatus var. *niger* Dum. & Mortil., Moll. Savoie, 1857, p. 13.
Limax cinereo-niger var. δ Stabile, Moll. Piemonte, 1864, p. 22, pl. 1, f. 2.
Limax cinereo-niger var. *nigripes* Stabile, Moll. Piemonte, 1864.
Limax cinereo-niger var. *malacologorum* Colbeau, Bull. Soc. Mal. Belg., 1867, p. 73.
Limax cinereo-niger var. *niger* Malm, Skand. Limac., 1868, p. 60, pl. 5, f. 12.
Limax ater Razoumowsky, Hist. Nat. Jorat, 1789, p. 266-67.
Limax cinereus var. *alpinus* Held, in Isis, 1837, p. 306.
Limax lineatus var. *albipes* Dum. & Mortil., Moll. Savoie, 1857, p. 13.
Limax engadinensis Heyn., Mal. Bl., 1862, p. 204.
Limax maximus var. *leucogaster* Mörch, Syn. Moll. Daniæ, 1864.
Limax montanus Leydig, Verhandl. Wurtt., 1871, p. 210.
Limax pironæ Pini, Moll. Esino, 1876, p. 36, pl. B, ff. 5, 6.

ANIMAL entirely black or blackish. Formula (321 123).

The form discriminated by Razoumowsky as **Limax ater**, as well as **L. maximus** var. **leucogaster** Mörch, **L. cinereus** var. **alpinus** Held, **L. engadinensis** Heyn., **L. lineata** var. **albipes** Dum. & Mortil., **L. montanus** Leydig, and **L. pironæ** Pini, may be regarded as sub-varieties of the var. *maura*, in which the dark pigmentation still presents a juvenile or primitive character, as it has not yet, or only partially, spread to the side areas of the sole.

This variety is essentially alpine, and more especially characteristic of exposed, elevated, or northern regions, its sombre colouring being probably a response to the peculiarities of the environment; several forms, however, retain one or more of the external features of a remote ancestor.

Somerset N.—Cleeve Combe (Norman, Som. Moll., 1860, p. 139).
Stafford—Shelbrook, Cannock Chase, June 1886! L. E. Adams.
Merioneth—Bont-ddu, Dolgelly, July 1886 (F. G. Fenn, J. of C., July 1887, p. 198).
Carnarvon—Llanbedrog, May 1901! C. Oldham.
York Mid W.—Shipley Glen, Sept. 1886! J. A. Hargreaves.

Germany—Fredrichsroda, Thuringia (E. von Martens, Jahrb. Deutsch. Mal. Ges., 1877, p. 214). Saxony, Dr. Collin (Malm, Skand. Limac., 1868, p. 60). The sub-var. *montana*, Ramsau, near Berchtesgaden; Isle of Herren, Chiemsee; Milseburg on the Rhine and Tubingen (Clessin, Exc. Moll. Fauna, 1884, p. 60).

France—Haute Savoie (Dum. & Mortil., op. cit.). Grande Chartreuse in the Isère (Moquin-Tandon, op. cit.). Plombières-les-Bains in the Vosges (Bourg., Spic. Mal., 1862, p. 20). Jura and Dauphiny (Bourg., Grande Chartreuse, 1862, p. 32).

Belgium—The sub-var. *malacologorum*, the ruins of Salm-Château, June 1867, (Colbeau, op. cit.).

Switzerland—Sub-var. *atra* Raz., Bad Leuk, and on the Gemmi Pass, also at Einfischthal near Bad Leuk (Böttger, Nachtbl., 1885, p. 57). Jorat (Raz., l.c.). The sub-var. *engadinensis* at St. Moritz, Grisons (Westerlund, Fauna Europ., 1876, p. 8).

Italy—The var. *maura* inhabits the elevated region of the Alps; the loftiest known locality in Italy is in Piedmont on Monte Mucrone, at an altitude of 2,200 metres (about 7,210 feet); other lofty stations in the same province are on Monte Cenisio; at Crissolo, in the Valle del Po; at Castelsee, and at Devero (Less. & Poll., Mon. Limac. Ital., 1882, p. 29). Thal von Thenaus, near Susa (Simon & Böttger, Nachtbl., 1884, p. 42). In Umbria, near Spoleto (Pantanelli, Bull. Soc. Mal. Ital., 1876). In Liguria, between Menton and Genoa, May 1890! J. E. Somerville. The sub-var. *pironae* on the Hill of Tenda and Monte Codena, also at Groscavallo, Valle di Lanza, in Lombardy (Less. & Poll., op. cit., p. 27).

The specimens from Orvieto in Umbria (Marchese Paulucci) and from Chiaramonti, Sardinia (Dr. Falchi) had the foot-sole pale and merely margined with black (Lessona & Pollonera, l.c.).

Austro-Hungary—Sub-var. *engadinensis*, Transylvania (Westerlund, op. cit., p. 8).

Norway—Very common in Christiania, Christiansand, and Hamar Stifts; also at Aafjorden, Vigten, Lekó, and Ródó, in Trondjhem Stift; and Grötö in Amt of Nordland. Sub-var. *leucogaster*, Laurvik and other places in Christiania Stift (Esmark, J. of Conch., Oct. 1886, p. 100).

Sweden—Sub-var. *niger*, Gunnebo and Ljungskile; Nerike (Hartmann), Stockholm (Thedenius) (Malm, op. cit., p. 61).

Russia—South Finland and Aland Isles, Nordenskiold and Nylander (Malm, op. cit.)

Var. **eporediensis** Lessona, Moll. Piemonte, 1880, p. 1, pl. 2, f. 18.

Limax subalpinus β eporediensis Lessona, op. cit.

BODY uniformly black; SHIELD blackish, sprinkled with whitish spots. Formula (321 123). Internal shell large, concave, and sinistral.

This variety, of which apparently only one specimen has been found, has, judging by its extremely abnormal shell, been of sinistral organization, with the respiratory and other orifices on the left side.

FIG. 81.—Internal shell of *Limax eporediensis* Lessona (after Lessona).

Not hitherto found in the British Isles.

Italy—Andrate above Ivrea, Piedmont (Less. & Poll., op. cit., p. 37).

FUNDAMENTAL BODY-COLOUR CINEREOUS.

Var. **cinerea** Moq.-Tand., Hist. Moll. France, 1855, ii., p. 29.

Limax cinereus α Müller, Verm. Hist., 1774, p. 5.
Limax maximus χ *cinerea* Moq.-Tand., op. cit.
Limax strobeli Pini, Moll. Esino, 1876, p. 22, pl. B, ff. 11, 12.

ANIMAL entirely cinereous, or ash-coloured; SHIELD bluish-black.

The sub-var. **strobeli** of Pini differs in the ash-colour of the body being tinged with yellowish, and the keel paler.

Galway—Killereran (B. J. Clarke, Ann. N.H., 1843, p. 333).

France—Distributed throughout the country, and also reported from Bastia in Corsica (Grateloup, Dist. Geog. Limac., 1855, p. 2).

Italy—The sub-var. *strobeli* at Maccugnaga, Val Anzasca, Piedmont, at an altitude of 1,323 metres (about 4,340 feet) (Lessona & Pollonera, op. cit.). Not rare about Esino, and in the Valle del Varone, near Premana in Lombardy (Pini, op. cit.).

FUNDAMENTAL BODY-COLOUR YELLOW.

Var. **flavescens** Westerlund, Moll. Svec., ii.

ANIMAL yellow or yellowish.

Sweden—Westerlund (op. cit.).

Var. **transilvanica** Heynemann, Mal. Bl., 1862, p. 216.

Limax transilvanica Heynemann, op. cit.
Limax dacampi var. *sordellii* Bettoni, Bull. Mal. Ital., 1870, p. 161, pl. iv., ff. 2, 2A.
Limax dacampi δ *calderinii* Lessona, Moll. Piemonte, 1880, p. 22, pl. i.,ff. 11-13.
Limax corsicus gestri π *nigrozonatus* Less. & Poll., Monog. Limac. Ital., 1882, p. 40.
Limax dacampi renieri ζ *calderinii* Less. & Poll., op. cit., p. 33.

KEEL and mid-dorsal-line yellow or ochreous, with a darker zone on each side of the body. Formula 001 100.

The var. **transilvanica** sensu stricto, has the keel-line and mantle pale, the body suffused with brown, and the dark lateral-band continued to the shield.

The sub-var. **calderinii** has the golden-yellow keel, but the median-line is continued to the shield as a series of spots, and gradually blends with the reddish-brown tint of the sides; the black lateral band is resolved into a series of spots, and the shield is paler than the body in colour.

The sub-var. **nigrozonata** has the keel and mid-line also golden-yellow, sides of body yellowish-ash colour, back fuscous, with the lateral-zone black.

The sub-var. **sordellii**, although somewhat obscurely described by Lessona & Pollonera, appears to have the keel and dorsal line yellow; sides of body ash-coloured, confusedly zoned, and irregularly albo-maculate; shield ash-coloured.

Italy—The var. *calderinii* is found at Varallo, in Val Sesia, Piedmont (Lessona, op. cit.). The sub-var. *nigrozonata* at Busalla, Piedmont, and at Genoa, Liguria; and the sub-var. *sordellii* at Pavia in Lombardy (Lessona & Pollonera, op. cit.).

Austro-Hungary—The var. *transilvanica* is found at Hermannstadt, Neustadt, and many other localities in Transylvania (Clessin, Moll. 1887, p. 39).

Var. **punctata** Lessona, Moll. Piemonte, 1880, p. 21, pl. i., f. 10.

Limax dacampi var. *elegans* Bettoni, Bull. Mal. Ital., 1870, p. 165, pl. iv., ff. 3, 3A.
Limax dacampi α *punctata* Lessona, op. cit.
Limax dacampi β *sulphurea* Lessona, op. cit., f. 7.
Limax dacampi menegazzii β *punctatus* Less. & Poll., Mon. Limac. Ital., 1882, p. 32.
Limax dacampi renieri η *sulphureus* Less. & Poll., op. cit., p. 33.
Limax corsicus var. *gestri* Lessona, op. cit., p. 17, pl. 1, f. 4.
Limax corsicus gestri ρ *pulcher* Lessona & Pollonera, op. cit., p. 41.
Limax perosinii monregalensis γ *venustissimus* Less. & Poll., op. cit., p. 43, pl. 1, f. 3.

KEEL and median-line yellow, with two darker zones at each side of the body. Formula 021 120. The var. *venustissima* retains when adult the variegated shield of juvenile life.

The var. **punctata** sensu stricto, has a pale yellow keel and the median-line continued as a series of yellowish markings to the shield; sides of the body fuscous overspread by grey, but leaving the fuscous body tint visible in places; a few rounded black or dark-grey spots represent the inner and main bands; caudal end of sides of body and foot-fringe dark-grey; shield uniformly dark-coloured.

Lessona's figure can scarcely be considered as accurately representing this variety.

The sub-var. **sulphurea** has the median-line sulphur-yellow and extending only half the length of the body; shield brown, with few black spots on its anterior margin.

The sub-var. **pulchra** has the yellow keel continued as a broad yellow zone quite up to the shield; the yellowish tint of the sides of the body is overspread by grey, leaving a series of yellowish spots beneath the main-band; the dark inner and main bands are distinguishable by the darker summits of the sinuate tubercles.

Mr. Roebuck has seen a British form of the sub-var. *pulchra* with ochreous median-line, dark-brown shield and body, and continuous main and inner bands.

The sub-var. **elegans** has the yellow keel line interrupted with black, and is possibly a form of this variety, but it has not been precisely described.

The sub-var. **venustissima** has the sides of the body an ashy-white, the margins blackish-grey, the lateral bands much broken-up into very irregular spots; side-areas of sole blackish-grey; shield pale sulphur-yellow marbled with black.

Sutherland E.—Sub-var. *pulchra*, Brora, Sept. 1884! W. Baillie.

Cork S.—Var. *punctata*, Lord Bantry's demesne, Glengariff, May 1891! R. F. Scharff.

Italy—The vars. *punctata* and *sulphurea* have been found at Varallo in Val Sesia, Piedmont; the sub-var. *pulchra* at Busalla, Piedmont, and at Genoa in Liguria; the sub-var. *elegans* at Biumo near Varese in Lombardy; and the sub-var. *venustissima* at Mondovi, Piedmont (Less. & Poll., op. cit.).

Var. **nigricans** Lessona, Moll. Piemonte, 1880, p. 22.

Limax dacampi renieri ζ nigricans Less. & Poll., Monog. Limac. Ital., 1882, p. 33.
Limax dacampi γ nigricans Lessona, op. cit.
Limax corsicus bonellii τ flavoniger Less. & Poll., op. cit., p. 41.
Limax corsicus bonellii φ olivaceus Less. & Poll., op. cit.

KEEL and median-line yellow, and extending to the shield; sides of body with two darker bands on each side. Formula (32)1 1(23).

The var. **nigricans** sensu stricto, has the sides of body black, keel yellow, and the mid-line to the shield broken up into yellow spots and showing a single series of sub-dorsal yellow spots on each side.

The sub-var. **flavo-nigra** has the yellow dorsal-zone extending up to the shield.

The sub-var. **olivacea** has olive-brown sides, with the keel, median-line, and a sub-dorsal series of spots lemon-yellow.

Not hitherto recorded for the British Isles.

Italy—The var. *nigricans* is found at Varallo in Val Sesia, Piedmont. The sub-var. *nigrozonata* has been recorded from Busalla, Val Scrivia, Piedmont, and at Genoa in Liguria. The sub-vars. *olivacea* and *flavonigra* are from Busalla and the Hills of Turin, and also from Liguria (Less. & Poll., op. cit.).

Var. **atrata** Bett., Bull. Malac. Ital., 1870, p. 165, pl. iii., ff. 4–4A.

Limax dacampi var. *atrata* Bettoni, op. cit.
Limax dacampi renieri γ atratus Less. & Poll., Monog. Limac. Ital., 1882, p. 32.
Limax corsicus bonellii σ aterrimus Less. & Poll., op. cit., p. 41.
Limax corsicus bonellii υ citrinus Less. & Poll., op. cit., p. 41.

KEEL and mid-dorsal-line yellow; body and SHIELD more or less unicolorous. Formula (321) (123).

The var. **atrata** sensu stricto, has the keel and dorsal-zone sulphur-yellow, sides of the body greyish-fuscous, with blackish rugosities, and blackish shield.

The sub-var. **aterrima** has the keel yellow, and body and shield very black.

The sub-var. **citrina** has the keel lemon-yellow, and only extending half the length of the body, which is of an olive-brown.

Not hitherto recorded for the British Isles.

Italy—The var. *atrata* is recorded by Bettoni from road between Perledo and Regoledo in Lombardy; the sub-var. *citrina* from the Hills of Turin, Piedmont, and Liguria; the sub-var. *aterrima* from the Hills of Turin, Piedmont, and Liguria, and by Marchese Paulucci from Lucca in Tuscany (Less. & Poll., l.c.).

Var. **efasciata** Dumont & Mortillet, Moll. Savoie, 1857, p. 13.

Limax lineatus var. *efasciatus* Dum. & Mort., op. cit.
Limax cinereus var. *pavesii* Pini, Moll. Esino, 1876, p. 23, pl. B, ff. 9, 10.
Limax maximus var. *calosoma* Eis. & Stuxb. (Westerlund, Faun. Europ., 1876, p. 8).
Limax cinereo-niger var. *minimus* Pollonera, Boll. Mus. Comp. Anat., 1898, p. 2.

ANIMAL with the fundamental body colour overspread with brownish or brown. Formula (321 123).

The var. **efasciata** sensu stricto, is described as entirely brown without bands.

The sub-var. **pavesii**, fuscous-chestnut, sole rosy-white with bluish-grey margins.

The sub-var. **minima** is ashy-fuscous, with the side-areas of the sole cinereous.

The sub-var. **calosoma** is of an obscure olivaceous tint; shield black.

Not hitherto recorded for the British Isles.

France—Var. *efasciata*, Haute Savoie (Dumont & Mortillet, op. cit.).

Italy—Sub-var. *pavesii* in Lombardy, between Tartavalle and Bellano, Aug. 1873 (Pini, op. cit.); in Piedmont at an altitude of 1,872 metres (about 6,135 feet), at Devoro, in Val d'Antigorio, and in Tuscany at Novoli, near Florence, Marchese Paulucci (Lessona & Pollonera, Monog. Limac. Ital., 1882, p. 29). The var. *efasciata* has been found at Alagna, Val Sesia (Lessona, Moll. Piemonte, p. 21).

Corsica—Sub-var. *minima*, Vizzavona, Signor Caziot (Pollonera, op. cit.).

FUNDAMENTAL BODY-COLOUR RED.

Var. **rufescens** Moq.-Tand., Hist. Moll. France, 1855, ii., p. 29, pl. iv., f. 7.

Limax maximus π rufescens Moq.-Tand., op. cit.
Limax erythrus Bourg., Mal. Grande Chartreuse, 1864, p. 31, pl. 2, ff. 1-8.
Limax dacampi τ monocromus Less. & Poll., Monog. Limac. Ital., 1882, p. 34.
Limax corsicus doriæ χ sanguineus Less. & Poll., op. cit., p. 39.

ANIMAL red or reddish.

The var. **rufescens** sensu stricto, is entirely of a reddish colour.

The sub-var. **sanguinea** is pale reddish with the keel and neighbouring rugæ red.

The sub-var. **monocroma** is entirely red, with side areas of sole fuscous.

The sub-var. **erythra** is deep red, with lateral blackish clouding on shield.

Not hitherto recorded for the British Isles.

France—Var. *rufescens* Moq., environs of Paris (Moq.-Tand., op. cit.). Sub-var. *erythra*, Alps, near Grande-Chartreuse in Isère (Bourg., op. cit.).

Italy—Sub-var. *sanguinea* Less. & Poll., Hills of Turin, Piedmont and Liguria (Less. & Poll., op. cit.). Sub-var. *monocroma* Less. & Poll., Balabio, near Valsassina in Lombardy (Pini, Moll. Esino, 1876, p. 28).

Austro-Hungary—Var. *rufescens*, Prague (Slavik, Moll. Böhmen, 1869, p. 92).

Var. **fabrei** Moquin-Tandon, Hist. Moll. France, 1855, ii., p. 26.

Limax corsicus β *fabrei* Moquin-Tandon, op. cit.
Limax dacampi var. *monolineolata* Bett., Bull. Mal. Ital., 1870, p. 161, pl. 3, f. 1.
Limax bielzii Seibert, Mal. Bl., 1873, p. 195.
Limax dacampi η *rufescens* Lessona, Moll. Piemonte, 1880, p. 22, pl. 1, ff. 14, 15.
Limax corsicus γ *senensis* Lessona & Pollonera, Monog. Limac. Ital., 1882, p. 38.
Limax corsicus callichrous o *hybridus* Lessona & Pollonera, op. cit., p. 40.
Limax corsicus callichrous ξ *versicolor* Lessona & Pollonera, op. cit., p. 40.

Keel and median-line red ; with a single dark zone on each side of the body. The formula is 001 100. The vars. *versicolor* and *hybrida* of L. & P. differ from the typical *fabrei* in the persistence at maturity of the variegated colouring of the shield.

The var. **fabrei** sensu stricto, has the keel reddish, the sides of the body greyish-ochreous, with one brown band on each side.

The sub-var. **monolineolata** is pale-reddish, keel and median-line red, with fuscous back, and a row of black spots on each side.

The sub-var. **rufescens** of Lessona has the keel of a vivid red, a unicolorous reddish body, paler on the sides, and the single row of black spots at each side is confined to the caudal end of the body.

The sub-var. **senensis** has the body and shield pale chestnut, the body subfasciate, the keel pale red, and the side areas of the sole flesh-coloured.

The sub-var. **bielzii** has the red keel extending to the shield, the sides of the body flesh-coloured, though sometimes found of a yellow or whitish colour, and the dark band is continued up to the shield.

The sub-var. **hybrida** has a fuscous body, red keel, and the red dorsal rugæ arranged linearly ; shield black, irregularly maculate with a vinous colour.

The sub-var. **versicolor** has the keel red, body yellowish with a blackish zone on each side ; shield black with vinous-yellow spots.

Not hitherto recorded for the British Isles.

Corsica—Var. *fabrei*, near Bastelica, Sept. 1852 (Moq.-Tandon, op. cit.) ; Orezza, Signor Bedriaga (Lessona & Pollonera, op. cit.) ; Corte, Toga, and Bastia, Signor Caziot (Pollonera, Bull. Mus. Comp. Anat., 1898, p. 2).

Italy—The sub-var. *monolineolata* is recorded from Milan, Pavia, and Bellagio, on the Lake of Como, by Bettoni, and by Pini from near Valsassina. The sub-var. *rufescens* is from Varallo in Val Sesia, Piedmont. The sub-var. *senensis* was found at Siena, Tuscany, by Marchese Paulucci. The sub-var. *versicolor* is found in the Alps of Liguria, and the sub-var. *hybrida* at Genoa (Lessona & Pollonera, op. cit.).

Austro-Hungary—The sub-var. *bielzii*, Moravia and Styria (Clessin, Moll., 1887).

Var. **villæ** Pini, Moll. Esino, 1876, p. 28, pl. A, ff. 2, 3.

Limax cinereo-niger var. *villæ* Pini, op. cit.
Limax dacampi ε *maculata* Lessona, Moll. Piemonte, 1880, p. 22, pl. 1, f. 6.
Limax dacampi ζ *pallescens* Lessona, l.c., ff. 8, 9.
Limax callichrous var. *cruentus* Lessona, op. cit., p. 18, pl. 1, ff. 1-3.
Limax dacampi υ *villæ* Lessona & Pollonera, Monog. Limac. Ital., 1882, p. 35.
Limax corsicus isselii λ *seriatus* Less. & Poll., op. cit., p. 40.
Limax perosinii Less. & Poll., op. cit., p. 42.
Limax perosinii cruentus β *formosissimus* Less. & Poll., op. cit., pl. 1, f. 2.

Keel and mid-line red, two rows of black maculations on each side of the body. Formula 021 120. The sub-vars. *cruenta* and *formosissima* are earlier forms of this variety, characterized by the ancient feature of a distinctly maculate shield.

The var. **villæ** sensu stricto, has the keel and summits of the rugæ blood-red, and the general tint of the body reddish ; two rows of irregular black spots on each side, most of which are longitudinally split, forming paired series of smaller spots.

The sub-var. **maculata** has a darker rufous body and less richly coloured rugæ.

The sub-var. **cruenta**, which is synonymous with *L. perosinii*, has the body rufous, with keel and summits of rugosities red, and two rows of irregular black spots on each side; side-areas of sole blue-black; shield reddish marbled with black.

The sub-var. **pallescens** of Lessona is probably only a young form of sub-var. *maculata*, in which the shield has slight grey cloudings and a few irregular black spots at its hinder margin, and although described as possessing three rows of black spots on each side, the figure shows that the irregular spots are longitudinally split and simulate additional rows, as in var. *villæ*.

The sub-var. **seriata** differs chiefly from the var. *villæ* s.s., in the black spots not being longitudinally split.

The sub-var. **formosissima** differs from var. *cruenta* in the bluish-black fringe, the more sparingly maculate shield, and the described presence of two or three rows of black spots on each side (the illustrative figure, however, shows only a single row at each side, though possibly intended to show two).

Not hitherto recorded for the British Isles.

Italy—The var. *villæ* is found near Esino, in Lombardy ; and the sub-vars. *maculata* and *pallescens* have been found together at an altitude of 490 metres (about 1,600 feet), at Varallo, in Val Sesia, Piedmont. The sub-var. *seriata* has been found at Busalla in Piedmont ; at Genoa in Liguria ; and by the Marchese Paulucci at Lucca in Tuscany. The sub-var. *cruenta* was found at an altitude of 650 metres (about 2,130 feet) above Garessio, in the Maritime Alps, Piedmont ; the sub-var. *formosissima* was found by Signor Perosino, near Mondovi, at Vicoforte, altitude 550 metres (about 1,800 feet), and at S. Guiseppe dei Revelli (Less. & Poll., op. cit.).

Var. **callichroa** Bourg., Spic. Mal., 1861, p. 21.

Limax callichrous Bourg., op. cit.
Limax cinereo-niger var. *gualtierii* Pini, Moll. Esino, 1876, p. 92, pl. A, ff. 8-9.
Limax dacampi o *gualtierii* Less. & Poll., Mon. Limac. Ital , 1882, p. 34.
Limax corsicus isselii μ *arthuri* Less. & Poll., op. cit., p. 40, pl. 1, f. 5.
Limax corsicus isselii ν *zonatus* Less. & Poll., op. cit.

Keel and median-line red ; with three dark bands on each side. Formula 321 123.

The var. **callichroa** s.st., has the sides of the body yellow, the two upper dark bands black and continuous, and the outer or lower band reduced to spots ; shield vinous-yellow marbled with black. It is really a primitive form, the marbled shield being retained throughout life.

The var. **gualtierii** is fuscous with a violet tinge, becoming blackish dorsally, but showing a longitudinal red line between the main and outer bands, and traces of a second red line between the main and inner bands ; shield earthy-brown.

The sub-var. **zonata** differs from the var. *gualtierii* in having the red keel and mid-line, and also the two red lines at each side of the body extending up to the shield, the intervening spaces being black and the shield brown.

The sub-var. **arthuri** differs from the preceding only in the disintegration of the red and black colouring, partially due to the red and black pigments both being restricted to the summits of the rugosities.

Not hitherto recorded for the British Isles.

Italy—The sub-var. *gualtierii* occurs in Esino, Lombardy ; the sub-vars. *arthuri* and *zonata* at Busalla, in Piedmont, and Genoa in Liguria (Less. & Poll., op. cit.).

France—Var. *callichroa*, the Alpes Maritimes (Bourg., op. cit.).

Var. **dacampi** Menegazzi, Mal. Veron., 1854, p. 63, p. 1, ff. 1-4.

Limax geographicus Renier, Prodr. Vermi Adriatico, 1804.
Limax dacampi Menegazzi, op. cit.
Limax cærulans var. *dacampi* Strobel, Essai, etc., 1857, p. 11.
Limax maximus var. *rufescens* Stabile, Moll. Terr. Piem., 1864.
Limax dacampi var. *trilineolata* Bett., Bull. Mal. Ital., 1870, p. 163, pl. 3, ff. 3, 3A.
Limax dacampi var. *fusca* Bett., l.c., pl. iv., ff. 1, 1A.
Limax corsicus doriæ η *fuscus* Less. & Poll., Monog. Limac. Ital., 1882, p. 39.
Limax corsicus doriæ ζ *rubro-notatus* Less. & Poll., l.c.

Keel and median line red ; with two darker zones at each side of the body. The formula being (32)1 1(23).

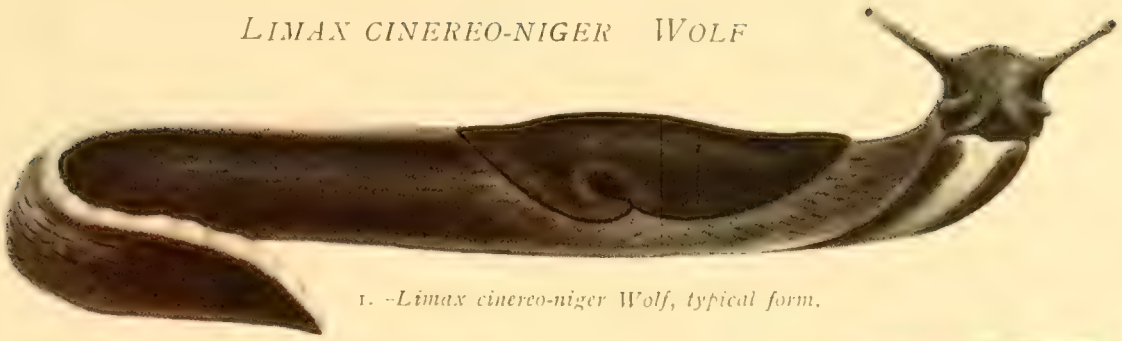
Though the name *geographicus* of Renier is probably the oldest name for this form, it has not been adopted as his description is so very inadequate.

The var. **dacampi** sensu stricto, has the keel and median-line red, with two black zones at each side, showing the reddish sides of the body as a reddish longitudinal zone on each side ; shield brownish-red.

The sub-var. **fusca** of Less. & Poll. differs from var. *dacampi* in the paler red of the keel-line and lateral bands, and in the fuscous tint of the sides and shield.

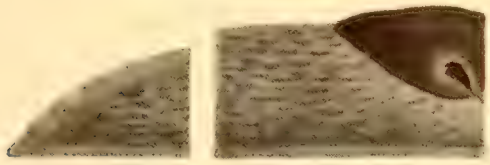
The sub-var. **trilineolata** has fuscous-brown sides and shield, and darker dorsal rugæ ; the red ground showing at the keel and as two lateral bands at the caudal end, but becoming obscured by the body-colour as they approach the shield.

LIMAX CINEREO-NIGER WOLF

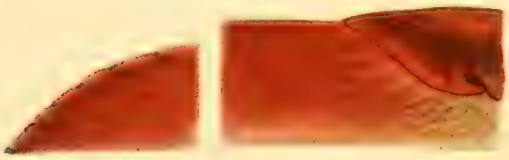


1.—*Limax cinereo-niger Wolf, typical form.*

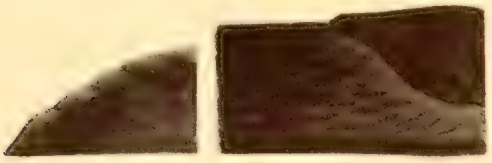
2.—*L. cinereo-niger var. pallescens, p.* 59.



3.—*L. cinereo-niger var. cinerea, p.* 62.

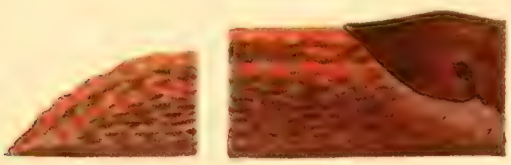


4.—*L. cinereo-niger sub.-var. erythra, p.* 65.

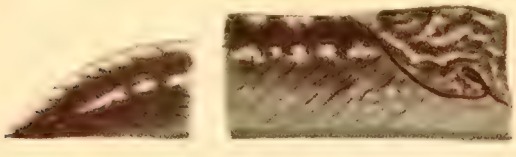


5.—*L. cinereo-niger var. maura, p.* 61.

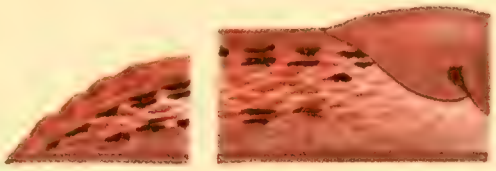
6.—*L. cinereo-niger sub.-var. venustissima, p.* 63.



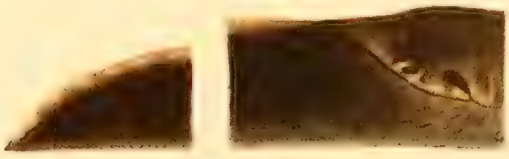
7.—*L. cinereo-niger sub.-var. gualtierii, p.* 66.



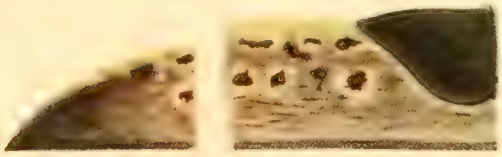
8.—*L. cinereo-niger sub.-var. subalpina, p.* 60.



9.—*L. cinereo-niger, var. villae, p.* 65.

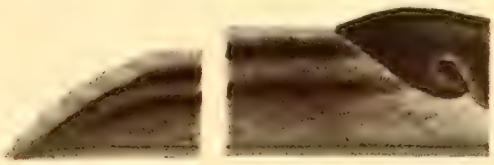


10.—*L. cinereo-niger sub.-var. hedleyi, p.* 61.

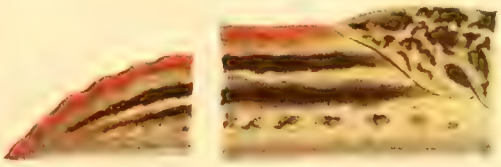


11.—*L. cinereo niger var. punctata, p.* 63.

12.—*L. cinereo-niger sub.-var. doriae, p.* 67.



13.—*L. cinereo niger var. zonata, p.* 59.



14.—*L. cinereo-niger var. albicincta, p.* 60.

15.—*L. cinereo-niger var. ornata, p.* 60.

J. W. Taylor, del.

Taylor Bros., Leeds.

192703

The sub-var. **fusca** of Bettoni is identical with sub-var. *trilineolata* except that the anterior end of the keel-line and also the whole length of the red lateral bands are interrupted by the brownish tint, and form three series of red spots.

The sub-var. **rubro-notata** Less. & Poll. has a blackish body, the red keel-line continued up to the shield, and the red lateral band on each side resolved into spots.

Not hitherto recorded for the British Isles.

Italy—The var. *dacampi* s.st., according to Lessona, exists in Venetia, Lombardy, East Piedmont, and Emilia, but does not pass the Appenines, and is therefore absent from Tuscany. It does not range to so great an altitude as typical *cinereo-niger*, the most lofty locality being Prestine, Valle dell' Oglio, 800 metres above the sea (about 2,710 feet) in Lombardy ; it has also been found at Varesotto and Valsassina. In Venetia it has been recorded from Verona, Peschiera, and Gorgo ; and in Piedmont from Cigognola, Stradella, and Guasta. The sub-var. *trilineolata* is found at Bellagio, and near Portone, Lombardy, and in Piedmont, Liguria, and Tuscany ; the sub-var. *rubro-notata* at Bellagio in Lombardy, on the Hills of Turin, and at Busalla in Piedmont, in Liguria, and in Tuscany. The sub-var. *fusca* Bettoni is found at Regoledo in Lombardy ; while the sub-var. *fusca* Less. & Poll. is from Liguria, and the Hills of Turin, and Busalla in Piedmont (Less. & Poll., op. cit.).

Var. **corsica** Moq.-Tand., Hist. Moll. France, 1855, ii., p. 26, pl. 3, ff. 10-13.

Limax corsicus Moquin-Tandon, op. cit.
Limax doriæ Bourg., Spicil. Mal., 1862, p. 23, pl. 15.
Limax cinereo-niger var. *taccanii* Pini, Moll. Esino, 1876, p. 91, pl. A, ff. 6-7.
Limax cinereo-niger var. *turatii* Pini, op cit., p. 95. pl. B, ff. 7, 8.
Limax dacampi μ *pinii* Less. & Poll., Monog. Limac. Ital., 1882, p. 34.
Limax corsicus doriæ ϵ *lineatus* Less. & Poll., op. cit., p. 39.
Limax corsicus doriæ δ *simplex* Less. & Poll., op. cit.
Limax corsicus doriæ ι *pallescens* Less. & Poll., op. cit.
Limax corsicus doriæ ζ *brunneus* Less. & Poll., op. cit.

KEEL and median line red ; sides of body and SHIELD more or less unicolorous. The formula is (321) (123).

The var. **corsica** sensu stricto, being first described and therefore giving the name to this variety, is an aberrant example of the red-keeled form ; the keel, though reddish, is not strongly coloured, and the sides of the body are ochreous-yellow tinged or overspread with grey ; this bleaching of the body colours is also shown by

The sub-var. **turatii** of Pini, in which although the keel is bright red, the sides of the body are pale ashy-rufous, and the side areas of the sole are not darkened.

The sub-var. **doriæ** Bourg., which more characteristically represents this variety, has an almost uniformly black body and blood-red keel, a line of which colour extends quite to the shield ; the var. *pinii* Less. & Poll. is practically identical.

The sub-var. **lineata** Less. & Poll. differs in the sides of the body being blackish.

The sub-var. **simplex** Less. & Poll. is the same, but the red keel only extends half-way to the shield ; figured by Bourguignat, Spic. Mal., 1862, pl. 16, ff. 4, 5, 8.

The sub-var. **brunnea** Less. & Poll. has the red keel and mid-line, but the body and shield are chestnut-brown ; also figured by Bourguignat, l.c., f. 9.

The sub-var. **pallescens** Less. & Poll. has the body and shield pale rufous-brown, with red keel and mid-line, and is also figured by Bourguignat, l.c., f. 7.

The sub-var. **taccanii** Pini only differs from characteristic sub-var. *doriæ* in the sides of the body and shield being of an earthy-brown colour and the suffusion of the mid-area of the sole with a yellowish-rosy tint.

Not hitherto recorded for the British Isles.

France—The sub-var. *doriæ* has been found in the environs of Nice and Menton, Alpes Maritimes (Bourg., Annales Mal., 1870, p. 135).

Italy—The sub-var. *doriæ* has been recorded from beneath bushes on the east side of the Vorbergs, near Bellagio, in Lombardy (Poulsen, Nachbl., 1872, p. 23), Savona, Finale, about Genoa especially near Pegli, in Liguria, also at Montferrat, the hills about Turin, and the Val Scrivia, at Busalla, in Piedmont ; and as var. *pinii* from Valsassina, near Pasturo, in Lombardy. The sub-vars. *simplex* and *lineata* have been found at Busalla and on the Hills of Turin in Piedmont, in Liguria, and in Tuscany ; sub-vars. *pallescens* and *sanguinea* at Busalla and on the Hills of Turin in Piedmont, and in Liguria ; sub-var. *brunnea* in Liguria; and sub-vars. *taccanii* and *turatii* at Esino, Lombardy (Lessona & Pollonera, op. cit.).

Bourguignat records as *Limax dacampi* var., a sub-variety with black sides, and greyish mid-line with red tuberculation, from Orbeletto, in the province of Rome.

Corsica—The var. *corsica* sensu stricto, Bastelica, Sept. 1852 (Moquin-Tandon, l.c.), Orezza, Signor Bedriaga (Lessona & Pollonera, l.c.)., Corte, Toga, and Bastia, Signor Caziot (Pollonera, Bull. Mus. Comp. Anat., 1898, p. 2).

Sardinia—The var. *corsica*, north of the island, Signor Genè (Less. & Poll., l.c.).

Geographical Distribution. — *Limax cinereo-niger* is widely and somewhat irregularly distributed, especially in the British Isles, and although the area occupied in continental Europe is fairly compact, the stations are usually more or less montane, and therefore to a large degree discontinuous, as it is frequently absent from the valleys and open grounds.

Its north-European range has been carefully worked out with especial reference to that of *Limax maximus*, and it is found to extend markedly beyond that of the latter species. In Norway, Esmark & Hoyer have foreshadowed its occurrence at Moskenaes, in Lofoten, 68° 6′ north latitude, while recording it as very common at Gröto in Nordland, which is 67° 49′ north latitude, and far beyond the known range of habitation of *Limax maximus*. In Sweden, it has been chronicled by A. Luther as existing at Funasdal, in Härjedal, 62° 30′ north latitude; while in Finland, according to the same author, it is tolerably common in the south-west, and reaches as high as 64° 30′ north latitude at Kivesvaara, in Paltamo, whereas *L. maximus* in that country is restricted to the neighbourhood of Helsingfors.

In the south of Europe, although a like discriminatory series of observations is not available, Fischer records that in the Pyrenees the *Limax maximus* only attains an altitude of 1,200 metres (about 3,930 feet), while the present species, according to Bourguignat, reaches in the same region almost to the snow-line.

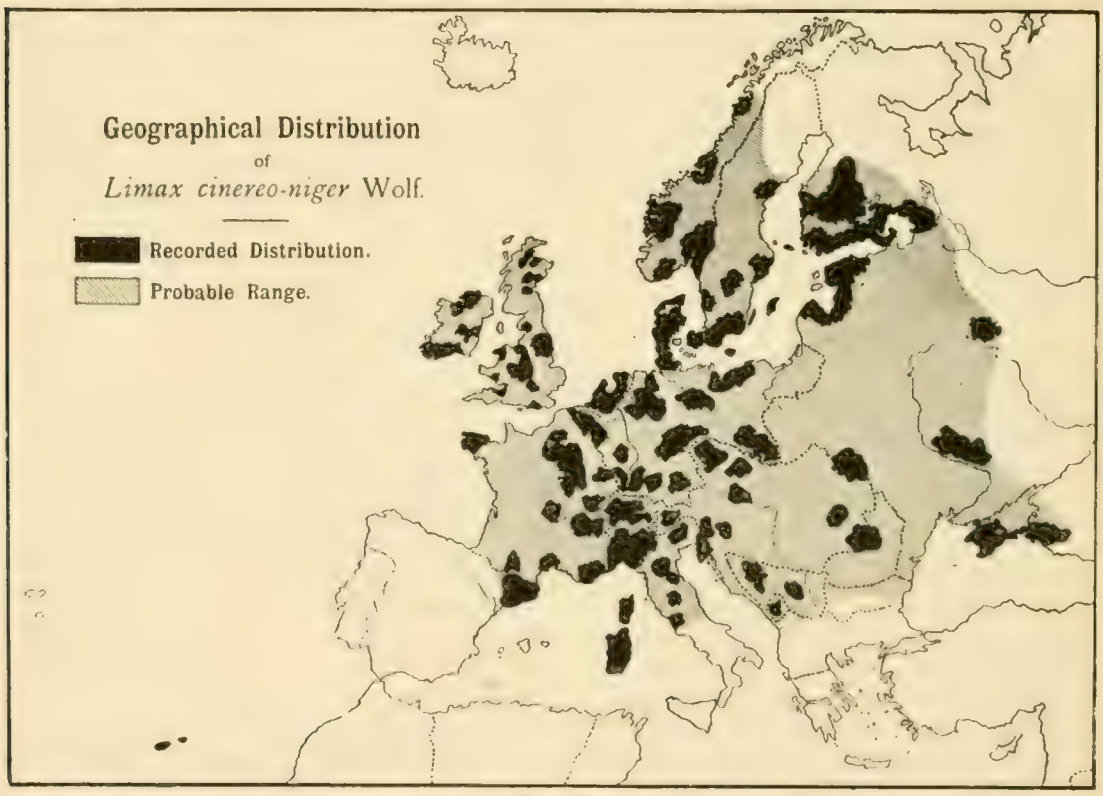


Fig. 82.

ENGLAND AND WALES.

PENINSULA.

Somerset N.—Var. *maura*, Cleeve Combe (Norman, Som. Moll., 1860, p. 139).

CHANNEL.

Sussex W.—Up Park, Aug. 1886! with var. *ornata*! W. Jeffery.

THAMES.

Oxford—Var. *vera* (W. E. Collinge, Oxfordshire list, 1891).

SEVERN.

Warwick—Sub-var. *luctuosa*, Sutton Park, July 1899! H. Overton.

Stafford—Var. *maura* and sub-var. *luctuosa* under a log, Shelbrook, Cannock Chase, near Stafford, June 3, 1886! Lionel E. Adams.

Salop—Oswestry, June 1885! Baker Hudson.

SOUTH WALES.

Glamorgan—Sub-var. *luctuosa*, Bridgend, July 1891 ! G. K. Gude.

NORTH WALES.

Merioneth—Bont-ddu, near Dolgelly, July 1886 ! F. G. Fenn.

Carnarvon—Bettws-y-Coed and Trefriw, May 1898, C. Oldham, J. of Conch., vol. ix., p. 211. Var. *maura*, Llanbedrog, May 1901 ! C. Oldham.

Denbigh—On the Denbighshire side of the river Conway near Bettws-y-Coed and Trefriw, May 1898 (C. Oldham, J. of Conch., vol. ix., p. 211).

Lincoln S.—Careby Wood, June 1903 ! E. A. Woodruffe-Peacock. *TRENT.*

Lincoln N.—Cadney, Sept. 1901 ! (E. A. Woodruffe-Peacock, Nat., Dec. 1901).

Derby—Chapel-en-le-Frith, July 1897 (C. Oldham, J. of Conch., vol. viii., p. 433). Not uncommon on the Derbyshire bank of the Goyt, May 1899 ! C. Oldham.

MERSEY.

Cheshire—Appears restricted to the hilly region in the east of the county ; not uncommon about Romiley, Compstall, and Marple in the Goyt Valley, and Wincle in the Dane Valley, under bark of fallen ash trees in wood, May 1899 ! C. Oldham.

HUMBER.

York N.E.—Farwath Bridge, Newtondale, Aug. 1886 ! W. Coates. Hayburn Wyke, Aug. 1894 ! F. W. Fierke. Sub-var. *luctuosa*, by Mill Beck, Robin Hood's Bay, June 1888 ! W. D. R. Var. *maura*, Roppa plantation, Bilsdale, alt. 900 feet, Aug. 1893 ! and sub-var. *luctuosa* and type, Wass Bank, Hambleton escarpment, 800 feet alt., Sept. 1892 ! W. D. Roebuck.

York S.E.—Var. *maura*, Brantinghamthorpe, May 1901 ! J. E. Crowther.

York S W.—Sub-var. *luctuosa*, Skelmanthorpe, May 13, 1897 ! F. Lawton.

York Mid W.—Banks of Lindley Wood Reservoir, July 1885 ! W. D. R. Sub-var. *luctuosa*, Shipley Glen, Oct. 1883 ! W. West. Var. *maura*, Shipley Glen, Sept. 1886 ! J. A. Hargreaves.

York N.W.—Sub-var. *luctuosa*, Helm Ghyll, Dentdale, May 1899 ! J. E. Crowther. Scarth Nick, Wensleydale, May 1888 ! John Braim. *LAKES.*

Westmorland and Lake Lancashire—Roadside between Water Yeat and Lake Bank, Sept. 6, 1902 (S. L. Petty, Nat., Nov. 1902, p. 366).

SCOTLAND. *EAST LOWLANDS.*

Edinburgh—Sub-var. *luctuosa*, Roslin woods, April 1898 ! W. Evans.

Forfar—Den of Airlie, Sept. 1886 ! C. B. Plowright. *EAST HIGHLANDS.*

Perth S. and Clackmannan—Loch Ard, April 1897, G. McDougall.

Perth Mid—Drummond Hill near Kenmore, Loch Tay, May 1892 ! W. Evans.

Easterness—Pine wood, Nethy Bridge, Inverness, July 1887 ! J. E. Somerville.

Banff—Glenfiddach, alt. 800 feet, July 1891 ! Rev. G. Gordon.

Elgin—Cromdale, 25th August, 1891 ! W. Evans. *WEST HIGHLANDS.*

Clyde Isles—Glen Rosa, Arran, April 1895 ! W. Evans.

NORTH HIGHLANDS.

Sutherland E.—Common, Blue Rock, near Loch Brora, June 1884 ! W. Baillie.

IRELAND. *ULSTER.*

Derry—Walworth Wood, J. N. Milne, as *L. hedleyi* (Collinge, J. of Mal., 1895).

[Monaghan]—Recorded in error, Census British Moll., 1902.

Tyrone—Altadiavol, type and var. *maura*, July 1886 ! and Derrygore, May 1887 ! W. F. de Vismes Kane.

Donegal—Sub-var. *luctuosa*, Ray Wood, Rathmullan, July 1903 ! J. N. Milne and R. Welch. Recorded as *L. hedleyi* from the same locality (Collinge, J. of Mal., 1894).

Dublin—Scalp, Dublin Mountains, July 1891, R. F. Scharff. *LEINSTER.*

Wicklow—Powerscourt, May 1886 ! W. F. de Vismes Kane.

Carlow—Near Carlow, 1890, A. G. Stuart.

Queen's Co.—Spire Hill (B. J. Clarke, Ann. and Mag. N.H., 1840, p. 203).

CONNAUGHT.

Sligo—Near Markree Castle, Sligo, Sept. 1885 ! W. F. de Vismes Kane.

MUNSTER.

Waterford—Glenabbey, type and var. *maura*, Sept. 1886 ! A. H. Delap.

Cork—R. Ball (B. J. Clarke, Ann. and Mag. N.H., 1843, p. 334).

Kerry—Upper Lake, Killarney, June 1885 ! W. F. de Vismes Kane. Glengariff (Scharff, Slugs of Ireland, 1891, p. 518).

GERMANY.

Is found in many parts of Germany, but is chiefly restricted to the forests, and has been recorded from Alsace, Altenburg, Bavaria, Baden, Brandenburg, Coburg, Lower Franconia, Hanover, Holstein, Lorraine, Nassau, Osnabruck, Oldenburg, East Pomerania, Rhineland, Saxony, Schleswig, Upper Silesia, Thuringia, Weimar, Westphalia, and Wurtemburg.

NETHERLANDS.

Holland—(Heynemann, Jahrb. Deutsch. Mal. Ges., 1885, p. 247).
Belgium—Brabant, Hainault, Luxembourg, Namur, and the Ardennes.

FRANCE.

Almost exclusively restricted to the vicinity of the mountains of the Vosges, Jura, Auvergne, Alpes Maritimes, and the Pyrenees, and is apparently absent from the plains, but is reported from Finistère in the extreme north-west. It has been recorded from Ain, Aisne, Alpes Maritimes, Aube, Côte d'Or, Finistère, Hérault, Isère, Marne, Nièvre, Oise, Puy-de-Dôme, Haute Savoie, Seine et Oise, Seine et Marne, Hautes Pyrénées, Var, and the Island of Corsica.

SWITZERLAND.

The cantons of Berne, Grisons, Lucerne, St. Gall, Solothurn, and the Valais.

ITALY.

The higher ground up to 2,200 metres (about 7,200 feet) in Piedmont, Liguria, Emilia, Tuscany, Rome, Lombardy, Venetia, and in the Island of Sardinia.

AUSTRO-HUNGARY.

Has been noticed in Austria, Bohemia, Upper Carinthia, Carniola, Galicia, Goritz, Hungary, Moravia, Silesia, Styria, Transylvania, and Tyrol.

SPAIN AND PORTUGAL.

Spain—Eastern provinces (Kreglinger, Cat., 1870, p. 22).

BALKAN PENINSULA.

Bosnia—Nemila (Bœttger, Jahrb. Deutsch. Mal. Ges., 1885, p. 54).
Montenegro—Budua (Clessin, Nachrichtsblatt, 1885, p. 179).
Servia—Serpentinberge (Möllendorff, Mal. Bl., 1873, p. 130).

SCANDINAVIA.

Norway—Extends to and is very common about Gröto in Nordland, 67° 49′ north latitude (Esmark & Hoyer, Moll. Arct. Norw., 1885, p. 98).
Sweden—Throughout the country as far north as Funasdal, about 62° 30′ north latitude (Luther, Finland list, 1901, p. 45).
Denmark—Common in the beech woods (Mahn, Skand. Limac., 1868, p. 59).

RUSSIA.

Found in the districts or provinces of Finland, Courland, Esthland, Livland, Moscow, Kharkov, Tchernigov, Crimea, and the Caucasus.

ATLANTIC ISLES.

Madeira—(Heynemann, Jahrb. Deutsch. Mal. Ges., 1885, p. 286).

FIG. 83.—A characteristic locality of *Limax cinereo-niger*, in the Goyt Valley, near Whaley Bridge, March 1903 (photo. by Mr. Baddeley).

Distribution of *L. cinereo-niger* Wolf

In the Counties and Vice-Counties of the British Isles.

ENGLAND AND WALES.

Channel Isles

PENINSULA
1 Cornwall W.
2 Cornwall E.
3 Devon S.
4 Devon N.
5 Somerset S.
6 Somerset N.

CHANNEL
7 Wilts N.
8 Wilts S.
9 Dorset
10 Isle of Wight
11 Hants S.
12 Hants N.
13 Sussex W.
14 Sussex E.

THAMES
15 Kent E.
16 Kent W.
17 Surrey
18 Essex S.
19 Essex N.
20 Herts.
21 Middlesex
22 Berks.
23 Oxford
24 Bucks.

ANGLIA
25 Suffolk E.
26 Suffolk W.
27 Norfolk E.
28 Norfolk W.
29 Cambridge
30 Bedford
31 Hunts.
32 Northampton

SEVERN
33 Gloucester E.
34 Gloucester W
35 Monmouth
36 Hereford
37 Worcester
38 Warwick
39 Stafford
40 Salop

SOUTH WALES
41 Glamorgan
42 Brecon
43 Radnor
44 Carmarthen
45 Pembroke
46 Cardigan

NORTH WALES
47 Montgomery
48 Merioneth
49 Carnarvon
50 Denbigh
51 Flint
52 Anglesey

TRENT
53 Lincoln S.
54 Lincoln N.
55 Leic. & Rutld.
56 Notts.
57 Derby

MERSEY
58 Cheshire
59 Lancashire S.
60 Lancashire Mid

HUMBER
61 S.E. York
62 N.E. York
63 S.W. York
64 Mid W. York
65 N.W. York

TYNE
66 Durham
67 Northumb. S.
68 Cheviotland

LAKES
69 Westmorland and L. Lancs.
70 Cumberland
71 Isle of Man

SCOTLAND.

W. LOWLANDS
72 Dumfries
73 Kirkcudbright
74 Wigtown
75 Ayr
76 Renfrew
77 Lanark

E. LOWLANDS
78 Peebles
79 Selkirk
80 Roxburgh
81 Berwick
82 Haddington
83 Edinburgh
84 Linlithgow

E. HIGHLANDS
85 Fife & Kinross
86 Stirling
87 Perth S. & Clkn
88 Mid Perth
89 Perth N.
90 Forfar
91 Kincardine
92 Aberdeen S.

E. HIGHLANDS
93 Aberdeen N.
94 Banff
95 Elgin
96 Easterness

W. HIGHLANDS
97 Westerness
98 Main Argyle
99 Dumbarton
100 Clyde Isles
101 Cantire
102 Ebudes S.
103 Ebudes Mid
104 Ebudes N

N. HIGHLANDS
105 Ross W.
106 Ross E.
107 Sutherland E.
108 Sutherland W.
109 Caithness

NORTH ISLES
110 Hebrides
111 Orkneys
112 Shetlands

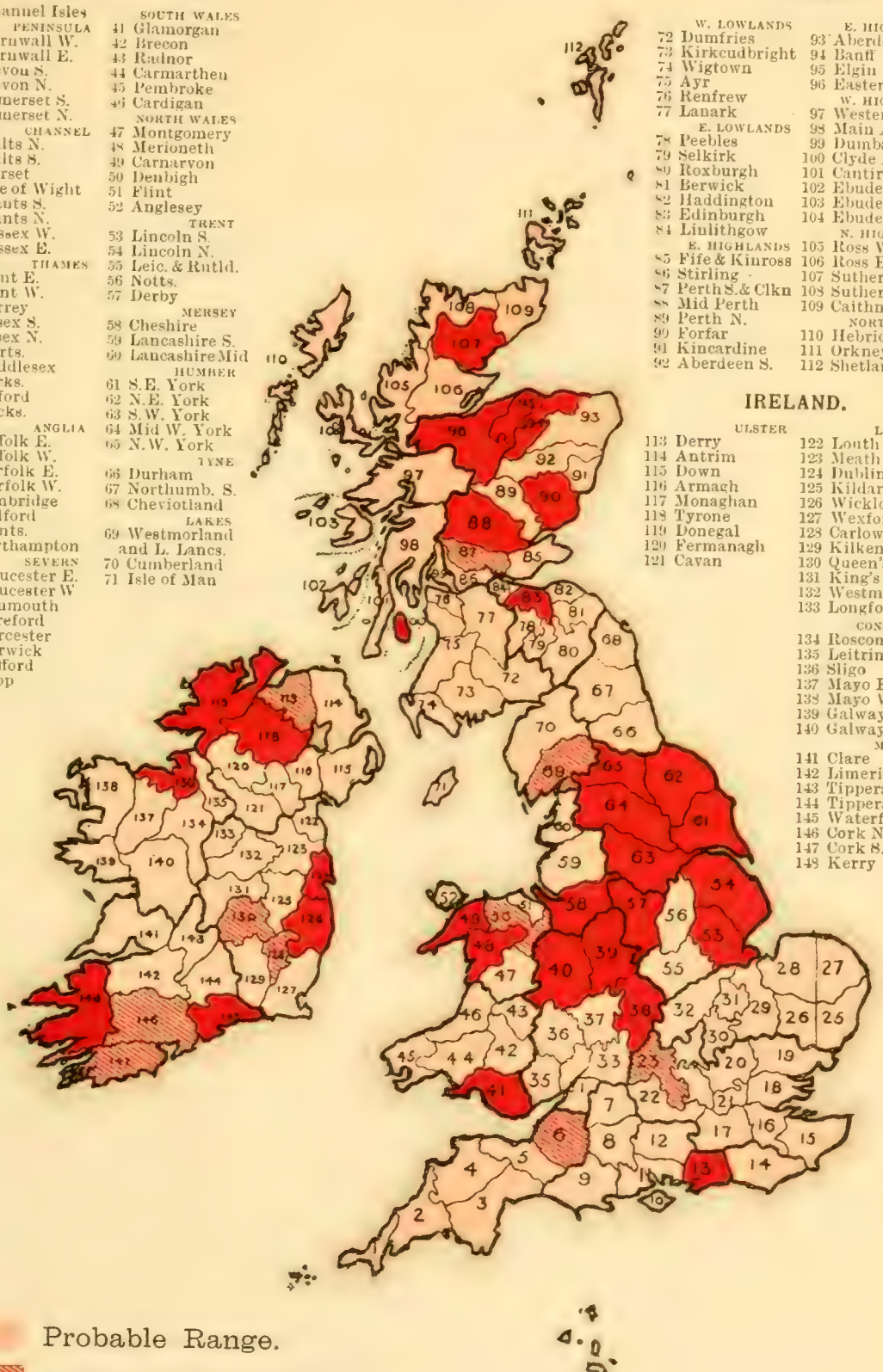
IRELAND.

ULSTER
113 Derry
114 Antrim
115 Down
116 Armagh
117 Monaghan
118 Tyrone
119 Donegal
120 Fermanagh
121 Cavan

LEINSTER
122 Louth
123 Meath
124 Dublin
125 Kildare
126 Wicklow
127 Wexford
128 Carlow
129 Kilkenny
130 Queen's Co.
131 King's Co.
132 Westmeath
133 Longford

CONNAUGHT
134 Roscommon
135 Leitrim
136 Sligo
137 Mayo E.
138 Mayo W.
139 Galway W.
140 Galway E.

MUNSTER
141 Clare
142 Limerick
143 Tipperary N.
144 Tipperary S
145 Waterford
146 Cork N.
147 Cork S.
148 Kerry



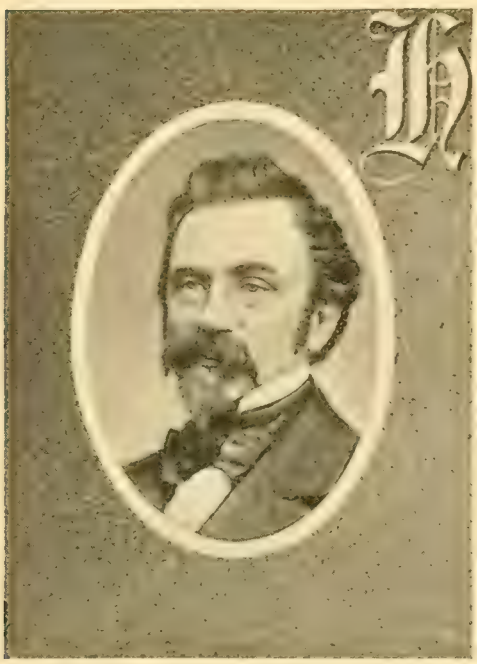
Probable Range.

Recorded Distribution.

Distribution verified by the Authors.

Limax tenellus Müller (em. Nilsson).

1774 **Limax tenellus** Müller, Verm. terr. et fluv., ii., p. 11, no. 210.
1822 — *tenellus* Nilsson, Hist. Moll. Sveciæ, p. 11.
1848 — *serotinus* Schrenk, Land u. Sussw. Livlands.
1849 — *cereus* Held, Land Moll. Bayern, p. 15.
1852 — *fulvus* Normand, Desc. Limac. Nouv., p. 7.
1852 — *sylvaticus* Dum. & Mortill., Moll. Savoie, p. 10.
1862 — *cinctus* Heynemann, Mal. Bl., viii., p. 101.
1868 *Malacolimax tenellus* Malm, Skand. Limac., p. 66, pl. iii., ff. 7-7f.
1869 *Arion tenellus* Letourneux, Moll. Vendée, p. 7.
1882 *Agriolimax tenellus* Less. & Poll., Monog. Limac. Ital., p. 45, pl. i., f. 7.



A. W. Malm

HISTORY.—*Limax tenellus* (*tenellus*, very slender or delicate) was first discriminated by Müller, whose name is accepted by Nilsson, the obvious error in the measurement being disregarded.

Heynemann, however, is of opinion that Müller's *Limax tenellus* is really an *Arion*, but ascribes to the *tenellus* of Nilsson the *Limax succineus*, *L. flavus*, and *L. cinctus*, all of Müller, the *L. succineus* and *L. flavus* being referred to the unicolorous, and *L. cinctus* to the banded form.

He also regards the *Limax collinus* Normand and the *Limax aureus* Gmelin as probably also referable to this species.

The late Dr. A. W. Malm, the eminent Swedish naturalist, with whom the present species has been associated, was so greatly impressed with its characters that he instituted a new genus, *Malacolimax*, for its reception, based upon the soft body, the tricuspid median-tooth, and the di-ectoconic marginals.

Lessona & Pollonera, while adopting Malm's name of *Malacolimax* as of sub-generic value, place it under *Agriolimax*, but, as shown by Simroth, it is probably most correctly associated with the typical Limaces, of which it is an ancient form, though he places it with *L. cephalonicus* and *L. subsaxanus* in a separate section, which he styles *Microheynemannia* to distinguish it from the *Macroheynemannia* to which *Limax maximus* and the larger species are relegated.

Diagnosis.—*Limax tenellus* differs from the species to which it is structurally most closely allied by its much smaller size, yellowish colour and black or blackish tentacles, its semi-transparent shell, and yellow mucus.

INTERNALLY, the reproductive organs are simple, the penis-sheath is short and swollen, and its retractor fixed near to and in front of the heart; the alimentary canal is almost a counterpart of that of juvenile *Limax maximus*, except that it presents indications of a cœcum or rectatheca.[1]

Original Description.—210. LIMAX TENELLUS. Limax virescens, capite tentaculisque nigris; long. 10 unc. Totus albidus *Clypeus* in luteum, *abdomen* in virescentem colorem aliquantum vergit; ille margine postico, hoc apice supra nigricat.

In Fossulis Nemorum foliis aridis repletis; primo vere. Müll., Verm. Hist. ii., p. 11.

1 Monog. i., p. 284, f. 566.

Description.—ANIMAL slender, very soft and viscous, with about thirty longitudinal rows of rugæ on each side of the body, of a pale yellowish, yellowish-grey, or greenish-white, but occasionally of a golden-yellow with orange shield, an obscure band on each side of the body and shield; SKIN soft and thick, becoming thin and tender when the animal is placed in alcohol, a change probably due to the large amount of mucus which is thrown off; HEAD and TENTACLES black or blackish-brown; hinder fifth of the body somewhat but not acutely keeled; SHIELD very obtusely angulated behind; SOLE transparently whitish or yellowish and tripartite; owing to this transparency of the median-area the foot-gland is clearly visible when the animal is crawling, and is seen to extend to the hinder-part of the body; the glandular lobules are also seen attached to the median-duct; MUCUS in half-grown or adult individuals of a yellow or orange colour. Length, 25-35 or more mill.

SHELL somewhat oblong, whitish, thin, and nearly transparent, slightly concave beneath, apex nearly terminal, with the usual concentric LINES OF GROWTH, margin rather broad, thin, and membranous. Length, 3½ mill.; breadth, 2 mill.

FIG. 85.—Internal shell of *L. tenellus* × 8 (Leipzig, Dr. Simroth).

INTERNALLY, the NERVOUS SYSTEM conforms to the general type, but the organ of Semper is horse-shoe shaped, like that of *L. maximus*, differing, however, in the cells being aggregated into five larger lobes around the mouth. The OSPHRADIUM is not distinctly perceptible, but may be detected by the slight furrowing defining it.

FIG. 87.

FIG. 86.—Otolith of *Limax tenellus*, highly magnified (after Schmidt).

FIG. 88.

FIG. 89.

FIG. 87.—Sexual organs of *L. tenellus* Müll. × 3 (after Simroth). *alb.g.* albumen gland; *h.* heart; *k.* kidney; *ov.* oviduct; *ot.* ovotestis; *p.* prostate; *p.s.* penis sheath; *r.m.* retractor muscle; *sp* spermatheca.

FIG. 88.—Penis-sheath of *L. tenellus* laid open, showing its internal structure, × 6 (after Simroth).

FIG. 89.—Alimentary canal of *Limax tenellus* Müll., × 3 (after Simroth).

The REPRODUCTIVE ORGANS are not complex; the OVOTESTIS is small, placed behind the stomach, and surrounded with dark-brown tissue; DUCT dark-brown, not convolute but greatly swollen in the middle of its course, and ending in a tiny spherical and white VESICULA SEMINALIS; ALBUMEN GLAND yellow, tender, and flaky; OVISPERMATODUCT relatively shorter than in *Limax maximus*, and only slightly connected together; OVIDUCT pale above, yellowish below, narrowing basally, and forming a thickened yellow base; SPERM-DUCT delicate above, but becoming a broad yellow glandular channel below, ending in a short broad VAS DEFERENS, which widens like a funnel, with a loose, plicate crest at its entry into the penis; the RETRACTOR arises from the same spot as a broad muscular band, and is distally attached to the floor of the lung, in the median-line in advance of the heart; SPERMATHECA oblong, with a long, slender stem, opening into the atrium; PENIS-SHEATH short, thick, and white, with a lateral protuberance near the base; interiorly there is a long, flatly projecting and finely plicate comb or crest, which is richly glandular, and encircles the opening of the vas deferens.

The CEPHALIC RETRACTOR arises as a simple broad, muscular band, in the median-line of the body, behind the lung. It does not divide into the normal three branches until the middle of its length.

The ALIMENTARY CANAL is set in delicate and black mesenteric tissue, and has five intestinal tracts in addition to the stomach tract as in *Limax maximus*, and is an almost exact counterpart of those of the very young examples of that species,

before the prolongation of the second intestinal tract takes place, except that there is an indication of a cœcum or rectatheca at the commencement of the rectum; the STOMACH is short and broad and honeycombed in texture; liver very soft and spongy, and usually red in colour, the left lobe being the most obvious.

The MANDIBLE or jaw is amber-brown in colour, very convex, rather narrow, but with somewhat elongate lateral limbs and straight ends, the lower outer angle of each limb acute, the upper angle correspondingly obtuse; the median-beak well marked and projecting boldly in front. Length one mill.

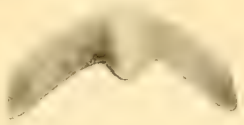


FIG. 90.—Mandible or jaw of *Limax tenellus* × 25 (Leipzig, Dr. Simroth).

The LINGUAL MEMBRANE of a specimen from the Harth, Leipzig, shows a distinctly tricuspidate median tooth; the laterals are unequally tricuspid; the endoconic cutting point being obsolete, but the ectoconic one strongly developed; the marginals become aculeate, but near the lateral series still exhibit three cutting points; the extreme marginals lose their inner cusp and become bicuspid, except for a few teeth which show vestiges of a second ectocone near the base.

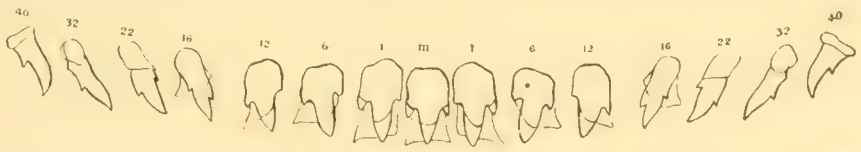


FIG. 91.—Representative denticles from a transverse row of the lingual teeth of *Limax tenellus* Müll. (highly magnified).
The animal collected by Dr. Simroth on the Harth, Leipzig, and the palate prepared by Mr. W. Moss.

Malm figures two distinct and prominent ectocones on the extreme marginals, but I have not been able to verify their presence in a well developed state in the Leipzig specimen.

The formula of a Leipzig specimen, supplied by Prof. Simroth, shows

$$\frac{27+14+1+1+1+27}{2\text{-}3 \qquad 3 \qquad 2\text{-}3} \times 110 = 9{,}130.$$

Food and Habits. — This little species is comparatively seldom observed, owing to the prevailing ignorance of its habits of life, and it is to be hoped that the claims of this species to rank as a British species will be firmly established now that attention is drawn to these peculiarities.

In Germany this slug is found on the pine-clad heaths or even in the remotest recesses of the great pine forests, where the ground is deeply covered with dense accumulations of pine needles and where scarcely a single blade of grass exists. On the fungoid growths, even in such places, *Limax tenellus* is almost certain to be found if sought for in autumn, when the slug is adult and the fungi at the highest period of their development. The mushroom gatherers in Germany, collecting slugs for Dr. Simroth, find *L. tenellus* to overwhelmingly outnumber *Arion subfuscus* and other species frequenting the same situations. In other countries, at or towards the limits of its geographical range, its habitat is not so restricted, and it may be frequently met with in the woods composed of beech and other deciduous trees.

Limax tenellus is of active habits, and, according to Simroth, lives exclusively on fungi, or, if the supply be restricted, becoming predatory or even cannibalistic; the Boletus is noted as especially preferred, while the poisonous red Agaric is also eaten on occasion.

Reproduction and Development. — According to Simroth, this species attains its full growth in October, living thence through the winter even into the early spring. During the colder season of the year the animals pair, and oviposition takes place in some suitable damp spot; the eggs, which are about two mill. in diameter, clear, transparent, and globular, are placed in clusters of thirty or forty; they hatch in a few weeks' time, the young adopting a subterranean life and feeding beneath the surface upon the mycelia of fungi quite into early summer, when they are about

half-grown; about July they appear above ground and feed upon the fungi, which at that period begin to flourish, the appearance of the slug being coincident with and dependent on the development and growth of the fungi upon which it feeds.

When young, the animals are almost unicolorous, and may then easily be confused with pale *Agriolimax lævis* or *A. agrestis*, but the polygonal reticulation of *L. agrestis* and the brownish tentacles of *L. lævis* aid us in their separation.

Their unicolorous state may be continued to adult life, but usually when about half-grown they acquire on each side of the mantle a brownish or black zone, which may later assume a lyre-shape. The inner side of this dark marking has a pale margin, and this gives rise to a darker median patch which when well defined assumes somewhat the shape of a hour-glass.

The mantle-band may occasionally extend to the body as a faint longitudinal zone. In addition there is a pale mid-dorsal or keel streak, which is quite broad at its origin, gradually narrowing, but widening again before finally contracting as it approaches the tail, which in young animals is tinged with a delicate carmine.

Variation.—*Limax tenellus* is not a very variable species, but there appear to be some differences recorded in the fundamental body-colour, and in addition there may be distinct lateral banding on the shield, which may extend upon the body also.

Dr. Westerlund, in his Fauna Europæ, 1876, p. 11, gives as a variety of this species the *Limax squammatinus* of Morelet, but this is really a species of *Geomalacus*.

According to Dumont & Mortillet's observation upon *Limax sylvaticus*, which Lessona & Pollonera allocate with *L. tenellus*, the banded variety is more especially an inhabitant of the mountains and exposed situations, the unicolorous form being more characteristic of the lower lands and umbrageous places; these features do not appear to be so well marked in their German habitats.

Var. **cerea** Held, Land Moll. Bayern, 1849, p. 15.

Limax sylvaticus var. *immaculatus* Dum. & Mortil., Mal. Savoie, 1857, p. 11.

ANIMAL of a somewhat uniform waxy-yellow colour, with only faint traces of lateral banding.

According to Dr. Westerlund the *Limax xanthius* Bourg., from Malberg, near Ems, in Germany, is an unicolorous yellowish variety of this species, and is probably referable to the var. *cerea*.

This form is also found at Augsburg, Munich, and on the mountains of the Traunstein, Bavaria; the Erzegebirge, and at Konigstein in Saxony, and if the reference by Lessona & Pollonera be correct, is also met with in Savoy, where it was recorded by Dumont & Mortillet as *L. sylvaticus* var. *immaculatus*.

The British and Scandinavian examples would appear to belong to this variety, as they are recorded as possessing only a slight lateral shading.

Var. **fulva** Normand, Desc. Limac. Nouv., 1852, p. 7.

Limax fulvus Normand, op. cit.

ANIMAL reddish-brown, suffused dorsally with black; SHIELD reddish-brown, scarcely obscured by some small pulviform blackish spots; tentacles vinous-brown; locomotory mucus colourless; BODY mucus yellow.

This variety, or geographical race, which was confused with *L. arborum* until shown by Simroth to be a form of *L. tenellus*, has been found at Valenciennes, in the department of the Nord, by Normand; in the Forest at Saint-Saulge, in the Nièvre, by Brevière; in the Forest of Hez, in the Oise, by Dr. Baudon; in the neighbourhood of Dijon, in the Côte d'Or, by Drouet; and at Luxembourg, in the department of the Seine, by M. Rétout.

Var. **cincta** Heynemann, Mal. Bl., 1862, p. 101.

Limax sylvaticus var. *clypeo-fasciata* Dum. & Mort., op. cit.
Limax sylvaticus var. *clypeo-concolor* Dum. & Mort., op. cit.

ANIMAL with distinct dark lateral bands on the shield, which occasionally extend upon the body.

This variety, which appears to be the most recently evolved form of this species, and to which the varieties *clypeo-fasciata* and *clypeo-concolor* of *Limax sylvaticus* Dumont & Mortillet, from Savoy, may probably also be referred as sub-varieties; the former has the longitudinally banded shield, while in the latter the banding is confined to the body.

It has also been reported from Eberbach, Baden; from various localities in Brandenburg; from Vegesack and the Harz Mountains in Hanover; from Stettin in Pomerania, and from the neighbourhood of Leipzig.

Geographical Distribution.—The range of this little-known species cannot be stated with any approach to real accuracy or precision.

An ancient form, as this is shown to be, and which its known habitat in the mountains or within the recesses of pine forests still further emphasizes, lead us to expect a much more extended distribution than has hitherto been recorded.

It has, however, been reported from Great Britain, France, Belgium, Germany, Austro-Hungary, Switzerland, Italy, Norway, Sweden, Denmark, Finland, Russia, and Palestine, and is said by Held to be especially plentiful in the Alps.

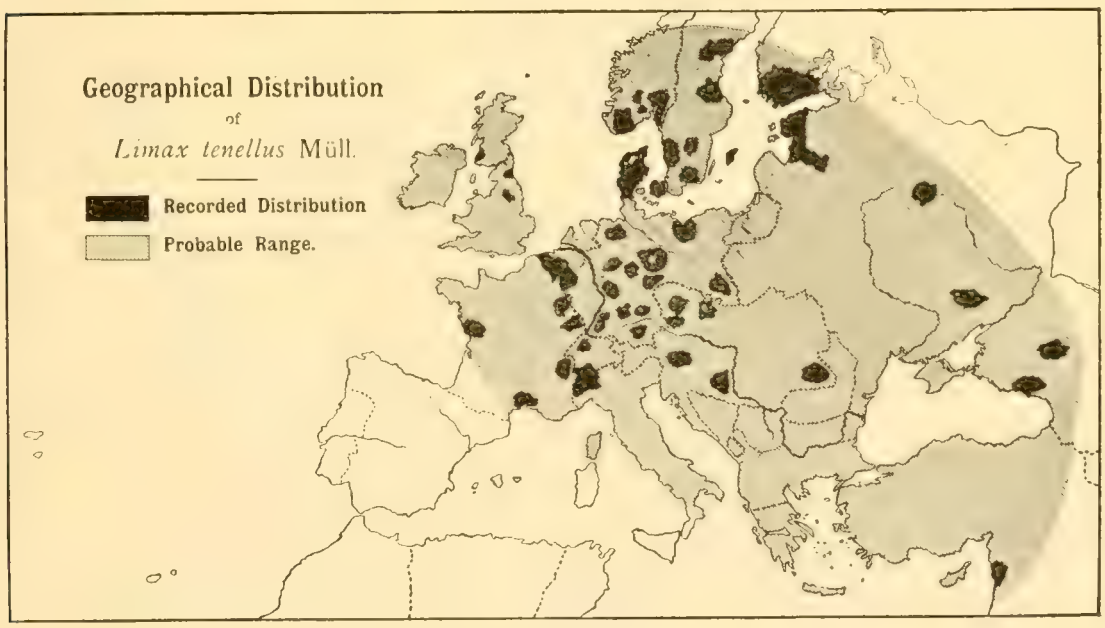


FIG. 92.

ENGLAND AND WALES. *HUMBER.*

York S.W.—Hemsworth and Sharlston, not common (Wilcock, Rep. Wakefield Nat. Soc., 1888, p. 28).

TYNE.

Durham—One specimen of the almost unicolorous yellow variety was found by Mr. Blacklock in a wood at Allansford, near Shotley Bridge, and sent to Mr. Alder (Forbes & Hanley, Brit. Moll., 1853, p. 21).

SCOTLAND. *WEST LOWLANDS.*

Ayr—Plentiful in hedge bottoms, near Irvine, June 1878 (J. Conachar, junr., Nat., July 1878, p. 177).

CLYDE ISLES.

Bute—Near Rothesay, June 1878 (J. Conachar, op. cit.).

NORTHERN ISLES.

Shetlands—North Mavine, on stones in the watercourse of a mountain mill (Jeffreys, Brit. Conch., 1862, p. 156).

GERMANY.

Throughout the country, but chiefly confined to the pine forests and mountain districts; it has been recorded from

Baden—Ditch near the "Gesprengte Thurm," Heidelberg (Daniels, Q.J.C., 1875, i., p. 112). Carlsruhe and Bühl (Gysser, Mal. Bl., 1865, p. 80). Var. *cincta*, Eberbach (Seibert, Nachtbl., June 1873, p. 46).

Bavaria—Bamberg (Schedel, Nachrichtsbl., 1886, p. 130). Var. *cerea*, Augsburg, Munich, and mountains in the Traunstein. Plentiful according to Herr Walser during November on mushrooms in woods.

Brandenburg—Heathy pine forests in the neighbourhood of Düben and Eilenburg (Simroth, Zeitschr., 1885). Pine forest, Glienicke, near Potsdam, H. Simroth.

Franconia—Kreuzberg, in forest near Convent (Clessin, Nachrichtsbl., 1884, p. 186).

Hanover—Var. *cincta*, Vegesack and the Harz Mountains (Simroth, op. cit.). Between the Elbe and the Ems (Borcherding, Abh. Ver. Brem., viii., 1883).

Lippe—Detmold (Borcherding, Mal. Bl., 1881, p. 16).

Nassau—Frankfurter Wald, and on the Taunus Mountains (Kobelt, Moll. Nassau, 1871, p. 78). Var. *xanthia* Bourg., Malberg near Ems (Westerlund, Fauna Europ., 1876, p. 11).

Pomerania—Var. *cincta*, Stettin (Lehmann, Mal. Bl., 1870, p. 95).

Pyrmont—Konigsberg (Hesse, Mal. Bl., 1880, p. 4).

Saxony—Var. *cincta* abundant in pine forests about Leipzig, Harth and Bienitz. Var. *cerea* in the red pine forests of the Erzegebirge, in the neighbourhood of Bienenmühle and Konigstein, Saxon Switzerland (Simroth, Zeitsch. Wissens. Zool., 1885). Common, but young, during June and July, at Old Stolberg, near Nordhausen (Hesse, Nachrichtsblatt, 1883, p. 44).

Schleswig—Flensburg (Friedel, Mal. Bl., 1870, p. 63).

Silesia—Landeck (Thamm, Nachbl., 1886, p. 150), and at Breslau.

NETHERLANDS.

Belgium—(Westerlund, Fauna Europ., 1876, p. 11).

FRANCE.

This species, according to Ferussac, is found in the south of France, in the Quercy, but it is questionable whether the identification is reliable.

Côte d'Or—*Limax fulvus*, environs of Dijon, H. Drouet (Baudon, Limac. Oise, 1871, p. 18).

Hérault—Montpellier (Férussac, Hist. Suppl., 1823, p. 96). St. Martin-de-Londres, Puéchabon (Dubrueil, Moll. Hérault, 1863, p. 4).

Meuse—(Buvignier, Cat. Moll. Meuse, 1890).

Nièvre—*Limax fulvus*, Forest of Saint-Saulge (Brevière, J. de Conch, 1881, p. 314).

Nord—*L. fulvus*, Valenciennes, Normand (Moq.-Tand., Hist. Moll., 1855, p. 32).

Oise—*Limax fulvus*, Forest of Hez (Baudon, op. cit.).

Savoy—*Limax sylvaticus* (Dum. & Mortil., Moll. Savoie, 1857).

Seine—*Limax fulvus*, Luxembourg, M. Rétout (Baudon, op. cit.).

Vendée—Fontenay-le-Comte (Letourneaux, Moll. Vendée, 1869, p. 7).

Vosges—Environs of Mirecourt (Puton, Moll. Vosges, 1847).

SWITZERLAND.

Solothurn—Weissenstein near Solothurn, at an altitude of about 4,000 feet (Blum, Nachrichtsbl., 1883, p. 163), and recorded doubtfully for French Switzerland by H. v. Ihering (Mal. Bl., 1881, p. 71).

ITALY.

Piedmont—Found at Gressoney St. Jean, at an altitude of 4,650 feet, and at the Alpi di Konichin in Val della Toce, at an elevation of about 7,200 feet. It had not previously been recorded for Italy, probably on account of being passed over and confused with *Agriolimax agrestis* (Lessona & Pollonera, op. cit., p. 46).

AUSTRO-HUNGARY.

Probably found throughout the whole region (Clessin, Moll. Oëst.-Ungarn, 1887).

Bohemia—Prague, J. F. Babor, 1894. Carlsbad (Gysser, Mal. Bl., 1864).

Moravia—Brünn (Clessin, Moll. Oëst.-Ungarn, 1887, p. 44).

Slavonia—(Möllendorff, Nachrichtsbl., 1871, p. 62).

Styria—Grimming (Clessin, op. cit.).

Transylvania—(Clessin, op. cit.).

Distribution of *Limax tenellus* Müll.

In the Counties and Vice-Counties of the British Isles.

ENGLAND AND WALES.

Channel Isles

PENINSULA
1 Cornwall W.
2 Cornwall E.
3 Devon S.
4 Devon N.
5 Somerset S.
6 Somerset N.

CHANNEL
7 Wilts N.
8 Wilts S.
9 Dorset
10 Isle of Wight
11 Hants S.
12 Hants N.
13 Sussex W.
14 Sussex E.

THAMES
15 Kent E.
16 Kent W.
17 Surrey
18 Essex S.
19 Essex N.
20 Herts.
21 Middlesex
22 Berks.
23 Oxford
24 Bucks.

ANGLIA
25 Suffolk E.
26 Suffolk W.
27 Norfolk E.
28 Norfolk W.
29 Cambridge
30 Bedford
31 Hunts.
32 Northampton

SEVERN
33 Gloucester E.
34 Gloucester W
35 Monmouth
36 Hereford
37 Worcester
38 Warwick
39 Stafford
40 Salop

SOUTH WALES
41 Glamorgan
42 Brecon
43 Radnor
44 Carmarthen
45 Pembroke
46 Cardigan

NORTH WALES
47 Montgomery
48 Merioneth
49 Carnarvon
50 Denbigh
51 Flint
52 Anglesey

TRENT
53 Lincoln S.
54 Lincoln N.
55 Leic. & Rutld.
56 Notts.
57 Derby

MERSEY
58 Cheshire
59 Lancashire S.
60 Lancashire Mid

HUMBER
61 S.E. York
62 N.E. York
63 S.W. York
64 Mid W. York
65 N.W. York

TYNE
66 Durham
67 Northumb. S.
68 Cheviotland

LAKES
69 Westmorland and L. Lancs.
70 Cumberland
71 Isle of Man

SCOTLAND.

W. LOWLANDS
72 Dumfries
73 Kirkcudbright
74 Wigtown
75 Ayr
76 Renfrew
77 Lanark

E. LOWLANDS
78 Peebles
79 Selkirk
80 Roxburgh
81 Berwick
82 Haddington
83 Edinburgh
84 Linlithgow

E. HIGHLANDS
85 Fife & Kinross
86 Stirling
87 Perth S. & Clkn
88 Mid Perth
89 Perth N.
90 Forfar
91 Kincardine
92 Aberdeen S.

E. HIGHLANDS
93 Aberdeen N.
94 Banff
95 Elgin
96 Easterness

W. HIGHLANDS
97 Westerness
98 Main Argyle
99 Dumbarton
100 Clyde Isles
101 Cantire
102 Ebudes S.
103 Ebudes Mid
104 Ebudes N

N. HIGHLANDS
105 Ross W.
106 Ross E.
107 Sutherland E.
108 Sutherland W.
109 Caithness

NORTH ISLES
110 Hebrides
111 Orkneys
112 Shetlands

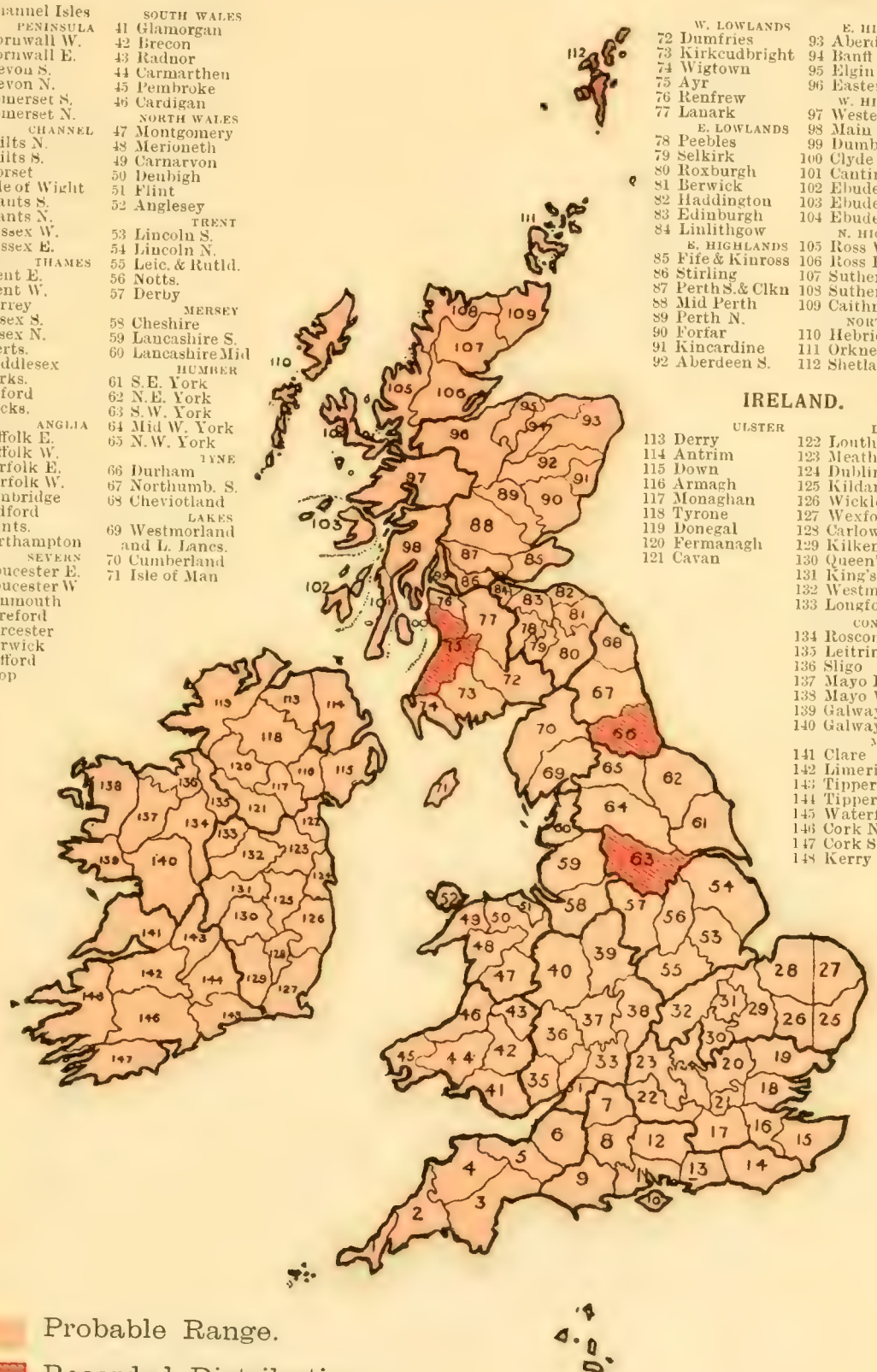
IRELAND.

ULSTER
113 Derry
114 Antrim
115 Down
116 Armagh
117 Monaghan
118 Tyrone
119 Donegal
120 Fermanagh
121 Cavan

LEINSTER
122 Louth
123 Meath
124 Dublin
125 Kildare
126 Wicklow
127 Wexford
128 Carlow
129 Kilkenny
130 Queen's Co.
131 King's Co.
132 Westmeath
133 Longford

CONNAUGHT
134 Roscommon
135 Leitrim
136 Sligo
137 Mayo E.
138 Mayo W.
139 Galway W.
140 Galway E.

MUNSTER
141 Clare
142 Limerick
143 Tipperary N.
144 Tipperary S
145 Waterford
146 Cork N.
147 Cork S.
148 Kerry



Probable Range.

Recorded Distribution.

Distribution verified by the Authors.

SCANDINAVIA.

Norway—Probably not so uncommon as previously believed. It is found in the park and oakwoods at Jarlsberg, Christiania, and Modum; by the lake Spirilen and other places in Christiania Stift; also known from several localities in Christiansand Stift (Esmark, J. of Conch., Oct. 1886, p. 101).

Sweden—The most northerly occurrence of this species is in Jämtland, 63°–64° north lat. (Luther, Moll. Finland, 1901, p. 46). Medelpad (Anderson, Mal. Bl., 1880, p. 152).

Malm records it from a birch wood, near Ljungskile, and also near Jonsered, and in the Castle wood, Göteborg, where it was abundant in October on the oak and other trees as well as on fungi. Westra Wram in Skane, rare, Lilljeborg. Ronneby in Blekinge, 1867, C. A. Westerlund; Gothland, in woody tracts in various parts of the island, G. Lindström (Malm, op. cit., p. 69).

Denmark—Not very common about Viborg, Jutland, according to Feddersen; common, in autumn, mostly in the cavities of fungi in the beech woods of the Isle of Zealand (Malm, 1868, p. 69).

RUSSIA.

Widely distributed in Russia, extending from Finland to the Caucasus; it has been recorded from several provinces, and according to Luther certainly inhabits Ingermanland.

Esthland—(Luther, Moll. Finland, 1901, p. 46).

Finland—Not rare in south and mid-Finland, and reaches as far north as Viitasaari and Kuopio at 63° north lat., seeming to prefer marshy ground and spruce fir-trees, but it also occurs amongst deciduous trees; in autumn it is frequently found on fungi (Luther, Moll. Finland, 1901, p. 46).

Kharkov—Among damp leaves, Sumy (Kaleniczenko, Bull. Mosc., 1851, p. 125).

Livonia—Dorpat (Braun, Nachrichtsbl., 1883, p. 174).

Moscow—Bielkovo near Moujevo (Milachevitch, Moll. Mosc., 1881).

Stavropol—About Stavropol in the Caucasus (Kaleniczenko, op. cit.).

Transcaucasia—Kutais (Bœttger, Nacht., 1881, p. 121).

Vitebsk—(Luther, Moll. Finland, 1901, p. 46).

ASIA MINOR.

Canon Tristram found several slugs in the moist valleys to the south of Lebanon in Palestine, which he was unable to separate in any way from the European species (Fauna and Flora of Palestine, 1885, p. 180).

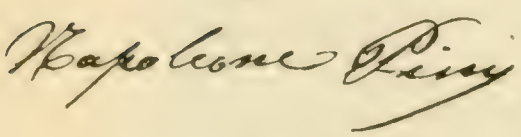
FIG. 93.—Pine forest, Glienicke, near Potsdam, Prussia, a stronghold of *Limax tenellus* (photo. by Prof. Krieger).

Sub-Genus *Lehmannia* Heynemann.

Limax flavus Linné.

1694 *Limax succini colore, albidis maculis insignitus* Lister, Exercit. Anat., t. 1.

1758 **Limax flavus** L., Syst. Nat., ed. x., vol. i., p. 652.
1801 — *variegatus* Drap., Tabl. Moll., p. 103.
1828 — *antiquorum* Sowerby, Genera of Shells, ii., p. 158.
1837 — *maculatus* Nunneley, Trans. Phil. and Lit. Soc. Leeds, i., p. 46, pl. 2, f. 3.
1844 — *umbrosus* Philippi, Enum. Moll. Siciliæ, ii., p. 102.
1862 — *deshayesii* Bourg., Spic. Mal., p. 36, pl. 1, ff. 1, 2.
1863 — *campanyoi* Bourg., Rév. et Mag. Zool., p. 179.
1865 — *bicolor* Selenka, Mal. Bl., xii., p. 105, pl. 2, ff. 10-17.
1868 — *baticus* Mabille, Rév. et Mag. Zool., p. 145.
1881 — *ecarinatus* Boettger, Jahrb. Deutsch. Mal. Gesellsch., p. 186, f. 7A-C.
1815 *Limacella unguiculus* Brard, Coq. Paris, p. 115, pl. 4, ff. 3, 4, 11.
1836 *Parmacella variegata* Philippi, Enum. Moll. Siciliæ, i., p. 125.
1851 *Krynickillus maculatus* Kaleniez., Bull. Soc. Imp. Moscou, p. 226, t. iv., f. 2.
1856 *Krynickia maculata* Fischer, Journ. de Conch., p. 66.
1864 *Limacus breckworthianus* Lehmann, Mal. Bl., xi., p. 145, pl. 4.
1868 *Eulimax (Plepticolimax) flavus* Malm, Skand. Limac., p. 62, pl. 4, f. 11.



HISTORY.—*Limax flavus* (*flavus*, yellow), was first discriminated by Lister, but Linné's name takes precedence, and although doubt has been cast by some writers on the correct identification of Linné's species, yet the description he gives, and his reference to the characteristic figure of Lister, would seem to remove all doubt on the subject.

This species is ranged under the subgeneric name of *Lehmannia*, to emphasize the presence of the cœcal appendage to the rectum, the chief difference its organization presents to that of the typical Limaces. This section is also known under the names of *Limacus*, *Plepticolimax*, and *Simrothia*.

With this fine species we associate Signor Napoleone Pini, who has so carefully studied the slugs of Lombardy, and to whom we are indebted for the discrimination of the varieties *tigrina* and *colubrina* of this species.

According to Herr Heynemann, *Limax ehrenbergi* Bourg. and *L. chilensis* are both probably referable to our *Limax flavus*, and Mr. C. T. Musson is of opinion that the *Limax megalodontes* of Quoy & Gaimard, from Port Jackson, also belongs to this species. The *L. flavus* var. *lineolatus* of Collinge, judging from the description, is more probably a variety of *L. arborum*.

Diagnosis.—*Limax flavus*, in its typical form, may be easily distinguished from the allied British species by its bluish tentacles, yellow mottled shield, and the oval yellowish rugæ interspersed over the body, which is of a dusky-yellow shade.

Internally, it shows a marked difference from the *Limax maximus* and *L. cinereo-niger* in the possession of a well-developed appendix or cœcum to the rectum, a peculiarity first pointed out and figured by Mr. Nunneley, of Leeds (Trans. Phil. Soc. Leeds, 1837, p. 58, pl. 2, f. 3).

Original Description.—LIMAX flavus. 7. L. flavus maculatus. *Fn. Suec.* 2092. *List. exercit. anat.* 1. *t.* 1. Limax succini colore, albidis maculis insignitus. *Habitat inter* Herbas (Linn., Syst. Nat., ed. x., p. 652, 1758).

Description.—ANIMAL with a long but somewhat stouter body than the congeneric species, and varying from 75 or 80 mill. to 100 or more mill. in length when extended; BODY rounded above, but keeled at the caudal extremity, usually of a dusky amber-yellow colour, overspread by grey, with the exception of certain rugæ which remain yellow and are distributed over the body singly or in combination; FOOT-SOLE longitudinally trifasciate, whitish with a faint tinge of yellow, sometimes narrowly margined with dusky-yellow; BODY-SLIME thin and light yellow in health, but dark-yellow, viscid, and copious when scalded; on removal of the mucus after scalding, the SKIN is seen to be of a dusky-grey; SHIELD narrow and rounded in front, broader and very obtusely angulated behind, of a dusky yellowish-grey colour, with many oval yellowish spots, paler towards the margins; RESPIRATORY ORIFICE posterior, surrounded by a raised and finely-spotted ring, broken anteriorly by the anal and renal fissures; inside of pulmonary cavity whitish; OMMATOPHORES stout and rather long, of a bluish colour, due to the colour of retractor muscles; LOCOMOTORY MUCUS plentiful and iridescent; the SUPRA-PEDAL GLAND has its bilaterally symmetrical halves arranged on either sides of the median-line, but does not extend into the tail, and, according to Rolleston, is underlaid by a large venous sinus, very visible in the living animal along the median-line of the foot.

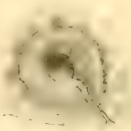


FIG. 96.—Respiratory orifice of *L. flavus*, × 3, showing the anal canal.

SHELL subquadrately oval, thin, white, and concave beneath, with corresponding convexity above; APEX or nucleus placed a little distance from the posterior margin and slightly to the left side, the concentric lines of increase usually well but not sharply marked; periostracal fringe broad and often somewhat calcified. Length, 9 mill.; breadth, 6 mill.

FIG. 97.—Internal shell of *L. flavus*, × 2. (Christchurch, Hants. S., Mr. C. Ashford).

INTERNALLY, the NERVOUS SYSTEM has slightly reniform or bilobed buccal ganglia with short connecting commissure; the OSPHRADIUM is in the form of a broad channel on the underside of the mantle roof, and extends from the respiratory orifice far over towards the left.

The REPRODUCTIVE ORGANS are not complex, and do not possess accessory organs. The OVOTESTIS is situate behind the stomach, and is light-coloured or brownish, often with large elements; the DUCT is white, slender and very tortuous, terminating in a small and round VESICULA SEMINALIS; ALBUMEN GLAND multilobed, flaky, and of a white or deep-yellow colour, increasing vastly in size at rutting time; the SPERM

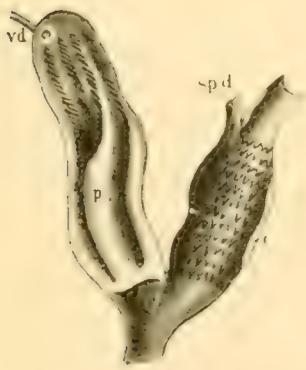


FIG. 98.

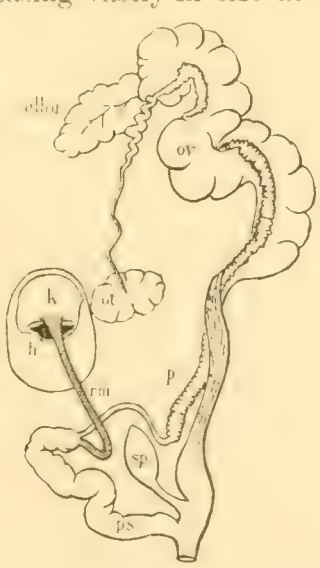


FIG. 99.

FIG. 100.

FIG. 98.—Penis-sheath and oviduct of *Limax flavus*, laid open to show the internal structure, enlarged (after Simroth). *v.d.* vas deferens; *p.* penis; *sp.d.* spermatheca duct; *ov.* oviduct.

FIG. 99.—Sexual organs of *Limax flavus*. *alb.g.* albumen gland; *h.* heart; *k.* kidney; *ov.* oviduct; *ot.* ovotestis; *p.* prostate; *p.s.* penis-sheath; *r.m.* retractor muscle; *sp.* spermatheca.

FIG. 100.—Hermaphrodite duct at junction with vesicula seminalis of *L. flavus* × 10 (after Scharff).

DUCT or PROSTATE is thick and yellow, with an immense number of minute, white, calcareous rods within its walls; the OVIDUCT is yellowish, gut-like, and thick-walled, but after separating from the prostate it narrows down and has thin walls, differing in structure from the upper albumen-secreting section; as it approaches the atrium it swells out, becomes thick-walled, and exhibits internally a succession of close-set glandular ridges and bright purple-red epithelium above; the fusiform SPERMATHECA which opens into the FREE-OVIDUCT in this region often contains a reddish substance, probably derived from the oviducal glands, and intended to aid in the preservation and vitality of the spermatozoids; the PENIS-SHEATH is long and cylindrical with a pronounced double flexure, connected by tissue which sometimes also involves the VAS DEFERENS and RETRACTOR; the latter is terminal, very long and ribbon-like, and fixed to the dorsum between the heart and the kidney; the penis-sheath has no interior crest, but in the lower half there are two projecting, longitudinal muscular rolls, while the walls above are thinner with many fine transverse plications.

FIG. 101.—Cephalic retractors of *Limax flavus*, × 2.

The CEPHALIC RETRACTOR arises usually in two or more roots beneath the hind margin of shield, and sooner or later unite into a short and stout band; about two-fifths of the total length of the retractor from the base, it divides as usual into the PHARYNGEAL and TENTACULAR branches; the pharyngeal bifurcates and fixes by the bifid end beneath the buccal bulb; the retractors to the ommatophores expand and become very bulky, but the subsidiary muscles to the anterior tentacles are comparatively slender, while the slip to the lips is quite short and insignificant.

The ALIMENTARY CANAL has the five intestinal coils and a stomach tract all without twist, and visible above the visceral mass when the body is opened, as in the typical Limaces; the intestinal coils are also held in position anteriorly, as in *L. maximus*,[1] by looping the aorta and the cephalic retractor, but differ in the presence of the rectatheca or cœcum, which is, however, only slightly attached to the rectum, and extends in the median-line of the body nearly to the tail-end. Simroth suggests that this appendage may act as an absorbent and imbibe the chyme from the intestinal canal by an antiperistaltic motion. The SALIVARY GLANDS are white and woolly, with a rather long duct to each; ŒSOPHAGUS short and pinkish-brown in colour, widening almost immediately after passing the nerve-ring into the CROP, which is brownish in colour with white veins and irregularly furrowed longitudinally and transversely; the LIVER or DIGESTIVE GLAND is usually of a yellowish grey, and consists of two main lobes connected each by a single duct to the digestive tube; the KIDNEY is brownish or in part crocus-yellow, and opens near the termination of the rectum in front of and at the upper part of the pulmonary aperture.

FIG. 102.—Alimentary canal of *Limax flavus*, showing the posteriorly directed appendix.

The MANDIBLE[2] or jaw is of a deep brown colour, strongly arcuate from front to back, smooth, with a blunt but prominent median rostrum or beak, which projects boldly in front and beneath, ends convexly rounded, and the upper part imbedded in the flesh well marked.

The LINGUAL MEMBRANE of a Cambridgeshire specimen, for which I am indebted to the Rev. Prof. Gwatkin, shows an obscurely tridentate median tooth, the mesocone large and well developed, but the ectocones not well marked and without noticeable cutting points; the laterals display the same characters, the mesocone

FIG. 103.—Representative denticles from a transverse row of the lingual teeth of *L. flavus* L., × 120. The animal collected in Cambridgeshire, and the palate prepared by the Rev. Prof. Gwatkin.

1 Monog., i., p. 285, ff. 570, 571. 2 Monog., i., p. 255, f. 511.

being strong and well developed, and the side-cutting points obsolete; the inner marginals are simply and strongly aculeate, but many of the extreme marginals show a clearly distinguishable ectocone which must not be confused with the angular appearance due to the basal corner of the tooth.

The formula is $\frac{34+11+20+1+20+11+34}{1\cdot2\quad1\qquad3\qquad1\quad1\cdot2} \times 153 = 20{,}043$.

Reproduction and Development.—The act of pairing does not appear to have been observed or recorded except by Férussac, who describes the heads of the coupled individuals as touching but laterally opposed during the act; it is, however, affirmed by Simroth that no spermatophore is formed, the seminal element being transferred in a fluid state.

The eggs are deposited in clusters of half-a-dozen to a score or more, beneath logs and in other moist and convenient places: they are at first colourless and perfectly translucent, tinged in some cases with amber, roundly oval in shape, soft and very elastic, and about seven mill. long and five mill. in diameter, usually though not invariably disposed in a series united together by a yellowish albuminous mucus with which they have become enveloped in their passage down the oviduct, and which by settling between the eggs gives them their acuminate aspect at the poles. Although the eggs are themselves very uniform in size, this mucous envelope varies so greatly in thickness that the eggs may appear to range in size from seven to eleven mill. in length even in the same batch. They are deposited from the beginning of July even into December, and hatch in from forty to sixty days, according to the weather, the young when hatched being about ten mill. long, and of a pale transparent yellow, or they may be somewhat greenish with a distinct light dorsal stripe and darker sides. They become adult within the year.

Food and Habits.—They are essentially nocturnal in habit, and very gregarious, often congregating together one upon another in a striking way for their siesta, and Bouchard-Chantereaux has remarked that one of their ommatophores is nearly always half extended at those times.

Though often found in moist woods and gardens, beneath turf, logs, under stones or bark of old trees, in crevices of walls, etc., yet this species would appear to prefer the shelter of artificial surroundings, being found most commonly in damp cellars, vaults, scullerries, drains, outhouses, sides of wells, and other similar places.

It is an active and voracious species, feeding greedily upon bread, cooked meat, and vegetables, and many kinds of table delicacies. It is also partial to cream, butter, flour, and even soap, and will grow sleek and fat upon the mildew found on damp walls. In a grocer's warehouse, in Leeds, *L. flavus* was noticed to show an especial predilection for brown sugar.

In a state of nature it is said not to devour the green leaves of phanerogamic plants, but to restrict itself to fungi and the minute lichens which stain the surface of old walls or are found upon the bark of trees; the stomach, under ordinary conditions, being filled with almost all kinds of garbage and mouldy growths. It will, however, eat the decayed leaves of Vinca and Primula.

In confinement, Mr. Gain offered 197 various kinds of food to this species, but only the Mushroom, *Psalliota campestris*, *Boletus edulis*, and the root of Carrot were eaten with avidity, though seventeen others were eaten freely, amongst which *Armillaria mellea*, *Russula heterophylla*, *Marasmius oreades*, *Polyporus squamosus*, the fruit of the Strawberry, the leaves of Holly and Bryony, the stalks of Lettuce and Cabbage, the roots of Potato, Turnip, and Swede may be especially mentioned.

The HOMING[1] faculty is strongly exemplified in this species, and this trait in its character has been often abundantly verified.

It is capable, at least when young, of spinning a mucous thread by which it can lower itself from branches or other places from which it may desire to descend.

Parasites.—*Limax flavus* is particularly liable to be infested by the ecto-parasitic *Acarus*, known as *Philodromus limacum*[2] L., a circumstance said by Férussac to be due to a strong odour resembling that of decaying wood which emanates from it and which also similarly attracts many wood-lice. This species is also preyed upon, according to Whiteaves, by the larva of the Coleopteron *Drilus flavescens*.

Variation.—This species, though under ordinary conditions remarkably constant in its coloration and character, is liable to a temporary change of aspect under the influence of prolonged abstinence from food or continued irritation. The yellow colour of the body being wholly or in great part due to the slime by which the body is invested, explains this transient instability of the colouring in this species.[3]

When living within the shelter of human habitations it is said to be more vividly coloured, but according to Locard does not attain to the size of the examples living in the open air. The brightness of its colouring becomes dimmed with the loss of its active energy, prolonged irritation, and abstinence from food, the yellow body-tint changing to a dull olive or grey. In the ordinary course, these animals in most districts darken with age, and as a rule are darker in colour out of doors than when living under shelter.

The chief differences are due to variations in the ground colour, and to the intensity and completeness of the suffusion by the darker secondary pigmentation, this suffusion emanating from the irregularly maculate markings, without exhibiting any tendency to run into banding.

Among the anomalies that have been observed, one with a well-marked bifurcate tail, found by Mr. C. Oldham, at Alderley Edge, in Cheshire, is worthy of especial mention.

VARIATIONS IN COLOUR OF ANIMAL.

Var. **albina** Taylor.

ANIMAL quite white.

Bavaria—Two specimens from the casemates at Wurzburg, June 1876 (S. Fries, Zool. Anz., 1879, p. 155).

Var. **flavescens** Fér., Hist. Moll., 1819, p. 71, pl. 5, f. 3.

ANIMAL yellowish, with markings indistinct.

Cornwall W.—Scilly Isles, Aug. 1890! Rev. E. Dale Roberts.

Surrey—Cobham, specimens in British Museum, from Dr. Leach (T. D. A. Cockerell, in litt.).

Middlesex—Muswell Hill road, Highgate, June 1889! H. Wallis Kew.

Elgin—South College, Elgin, Dec. 1890! G. Gordon.

Belgium—Brussels and Louvain (Colbeau, Ann. Soc. Mal. Belg., 1863, p. 48).

France—Frequent in moist and cold houses in Lyons; rather common in vaults and cellars in the department of the Ain; and at Montpellier, Béziers, Lodève, St.-Pons, Ganges, etc., in the Hérault.

Italy—Liguria, Tuscany, Sardinia, and Sicily (Lessona & Pollonera, Monog. Limac. Ital., 1882, p. 44).

Var. **rufescens** Moq.-Tand., Hist. Moll. France, 1855, p. 25.

ANIMAL reddish, with the markings somewhat indistinct.

Warwick—Stratford-on-Avon, Sept. 1884! R. J. Attye. Cellar, Edgbaston, July 1898 (Collinge, J. of Mal., Dec. 1898, p. 56).

1 Monog. i., p. 312, f. 602. 2 Monog. i., p. 423, f. 738. 3 Monog. i., p. 327.

LIMAX.

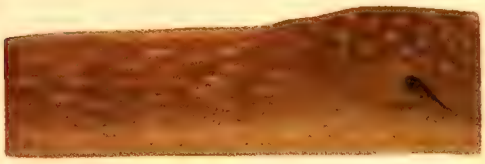
1. *Limax tenellus, p. 71.*
(after original drawing by Joshua Alder).

3. *Limax tenellus var. cerea, p. 74*
Masham, Yorks, W. A. Thwaites.

2. *Limax tenellus var. fulva, p.*
Loughton, Essex, T. Petch.

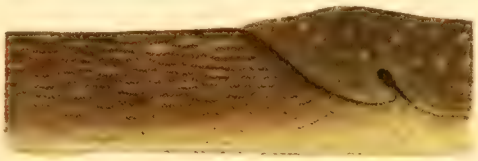
4. *Limax tenellus, young.*
(after Simroth).

5. *Limax flavus, p. 78.*
Leeds.



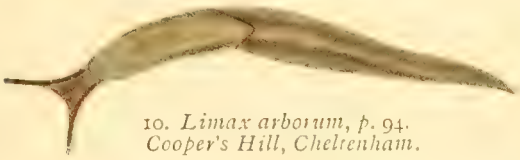
6. *Limax flavus var. rufescens, p. 82.*
Bowes Castle, T. Sheppard.

8. *Limax flavus var. grisea, p. 84.*
Bath, C. J. Waterfall.

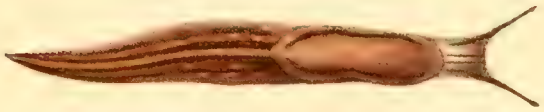


7. *Limax flavus var. virescens, p. 83.*
South Stockton, B. Hudson.

9. *Limax flavus var. maculata, p. 83.*
Ratham, W. Jeffery.



10. *Limax arborum, p. 94.*
Cooper's Hill, Cheltenham.



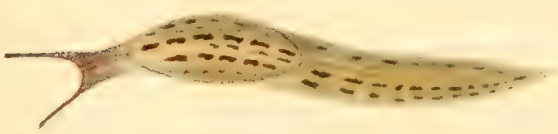
14. *Limax arborum var. nemorosa, p. 95.*
Banchory, W. Evans.

11. *Limax arborum var. subrufa, p. 94.*
Chapel-en-le-Frith, C. Oldham.

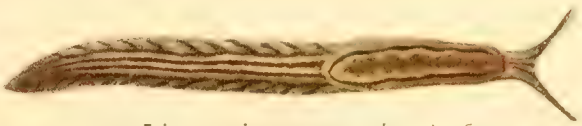
15. *Limax arborum subvar, alpestris, p. 96.*
Shetlands, Rev. R. W. J. Smart.

12. *Limax arborum subvar. submaculata, p. 96.*
Cushendun, Rev. S. A. Brenan.

16. *Limax arborum subvar. bettonii, p. 95.*
Cushendun, Rev. S. A. Brenan.



13. *Limax arborum var. tigrina, p. 96.*
(after Weinland).



17. *Limax arborum var. zebra, p. 96.*
(after Simroth).

Lancashire S.—Knowsley near Liverpool, 1893 (Collinge, J. of Mal., 1893, p. 148).
Lancashire W.—Timber yard, Avenham lane, Preston, 1889! W. H. Heathcote.
France—(Moquin-Tandon, op. cit.).
Italy—All Italy (Lessona & Pollonera, Monog. Limac. Ital., 1882).

Var. **virescens** Fér., Hist. Moll., 1819, p. 71, pl. 5, f. 2.

ANIMAL almost uniformly greenish, the markings nearly obliterated.
Kent W.—Chislehurst, May 1885! T. D. A. Cockerell.
Pembroke—North Cliff near Tenby Harbour (Stubbs, J. of Conch., 1900, p. 322).
York N.E.—South Stockton, Dec. 1884! Baker Hudson.
France—(Moquin-Tandon, op. cit.).
Italy—Liguria (Lessona & Pollonera, op. cit.). Esino, Lombardy (Pini, 1876).
Madeira—(Grateloup, Dist. Geog. Limac., 1855).

VARIATIONS IN MARKINGS OF ANIMAL.

Var. **antiquorum** Sowerby, Genera of Shells, 1828, ii., pl. 158.

Limax bæticus Mab., Rev. et Mag. Zool., 1868, p. 145.

ANIMAL pale ochreous, marbled on mantle and back with greyish interstitial lineolation or reticulation.

Surrey—Specimens in British Museum, labelled "Cobham, Dr. Leach" (T. D. A. Cockerell, 1891).
Portugal—Lisbon (Morelet, Moll. Portugal, 1845, p. 34).

Var. **tigrina** Pini, Bull. Soc. Mal. Ital., 1876, p. 96.

Limax variegatus var. *tigrinus* Pini, op. cit.

ANIMAL rufous-yellow, variegated with black, mid-dorsal line rufous-yellow and uninterrupted.

Italy—Esino, Lombardy (Pini, op. cit.).

Var. **umbrosa** Philippi, Enum. Moll. Siciliæ, 1844, ii., p. 102.

Limax umbrosus Phil , op. cit.
Krynickillus maculatus Kal., Bull. Soc. Imp. Mosc., 1851, p. 226, pl. 4, f. 2.
Limax maculatus Leach, Syn., 1852, p. 52.
Limax variegatus var. *colubrinus* Pini, op. cit.

ANIMAL ochreous-yellow or brown, with darker markings superposed.

The *L. umbrosus* has the darker colouring brownish, while the sub-var. *maculata* Kal. has it dark-grey or blackish ; the *maculata* of Moquin-Tandon has the ground colour more of a brownish shade, and the markings are described as black.

Sussex W.—Sub-var. *maculata* Kal., Ratham, Nov. 1886 ! W. Jeffery.
Kent E.—Sub-var. *colubrina*, Maidstone, Nov. 1888 ! F. G. Fenn.
Middlesex—Sub-var. *maculata* Kal., Southwood road, Highgate, June 1889 ! H. W. Kew. Hillingdon near Uxbridge, Oldfield Thomas. Bedford Park, T. D. A. Cockerell. Specimens in British Museum, presented by Dr. Leach, from the cellars of three localities in London (T. D. A. Cockerell, 1891).
Bucks.—Sub-var. *maculata* Kal., Eton, Dr. Leach, specimens in British Museum (T. D. A. Cockerell, 1891).
Notts.—Sub-var. *colubrina*, Tuxford (W. A. Gain, Brit. Nat., Nov. 1893).
York N.E.—Sub-var. *colubrina*, South Stockton, Dec. 1884 ! Baker Hudson.
Edinburgh—*L. maculatus*, common on hills about Edinburgh (Leach, op. cit).
France—Sub-var. *maculata*, Montpellier, Béziers, Lodève, St.-Pons, Ganges, etc. (Dubrueil, Moll. Hérault, 1863, p. 3).
Belgium—Sub-var. *maculata*, Brussels (Colbeau, Ann. Soc. Mal. Belg., 1863, p. 48).
Italy—Sub-var. *colubrina*, Esino, Lombardy (Pini, Moll. Esino, 1876). Sub-var. *maculata*, Esino in Lombardy (Pini, op. cit.). Var. *umbrosa* Phil., Sicily.
St. Helena—Sub-var. *maculata* Kal., specimens in British Museum, from J. C. Melliss (T. D. A. Cockerell, 1891).
United States—Sub-var. *maculata* Kal., specimens in British Museum, labelled "Savannah, Georgia, W. G. Binney" (T. D. A. Cockerell, 1891).
Australia—Sub-var. *maculata* Kal., specimens from Sydney, New South Wales, in British Museum (T. D. A. Cockerell, 1891).
Polynesia—Sub-var. *maculata* Kal., specimens from Rarotonga, Cook Islands, and New Hebrides, collected by Rev. Wyatt Gill, are in the British Museum (T. D. A. Cockerell, 1891).

Var. **breckworthiana** Lehmann, Mal. Bl., 1864, p. 145, pl. 4.

Limacus breckworthianus Lehmann, op. cit.
Limax ecarinatus Boettger, Jahrb. Deutsch. Mal. Ges., 1881, p. 186, f. 7a-c.
Limax flavus var. *suffusa* Roebuck, J. of Conch., July 1885, p. 352.
Limax flavus var. *grisea* Roebuck, J. of Conch., July 1884, p. 222.

The whole BODY and SHIELD uniformly suffused by a dark colouring.

The varieties *breckworthiana*, *ecarinata*, and *suffusa* are all said to be characterized by the diffusion of the secondary pigmentation over almost the whole surface of the body, which therefore presents an almost uniform colouring.

The sub-var. *grisea* differs in the mottled markings being still visible on the body and shield, although the yellow ground tint has been replaced by grey and the body slime is colourless.

Somerset N.—Sub-var. *grisea*, Bath, June 1884 ! C. J. Waterfall.

Middlesex—Sub-var. *suffusa*, Ealing, May 1885 ! S. C. Cockerell. Sub-var. *grisea*, Acton, Jan. 1885! T. D. A. Cockerell. Hampstead, June 1888 ! H. Wallis Kew.

Stafford—Sub-var. *grisea*, Mr. Nash's garden, Stafford, Dec. 1886 ! L. E. Adams.

Renfrew—Sub-var. *grisea*, near Greenock, Sept. 1886 ! Andrew Scott.

Russia—The sub-var. *ecarinata*, Kutais, Transcaucasia ; similar specimens from Sebastopol in Crimea (Simroth, Nacktsch., 1891, p. 308).

Australia—Var. *breckworthiana*, Breckworth, Victoria (Lehmann, l.c.).

Geographical Distribution.—The natural range of *Limax flavus* is very compact, and includes the whole of temperate Europe. It has been reported from the British Isles, Germany, France, Corsica, Belgium, Holland, Spain, Portugal, Balearic Isles, Italy, Sardinia, Sicily, Greece, Denmark, Russia, Asia Minor, Algeria, Cyprus, and other Mediterranean Isles.

It has also been noted as occurring in Madeira, Azores, St. Helena, Seychelles, Eastern North America, South America, Australia, New Zealand, Japan, and South Africa.

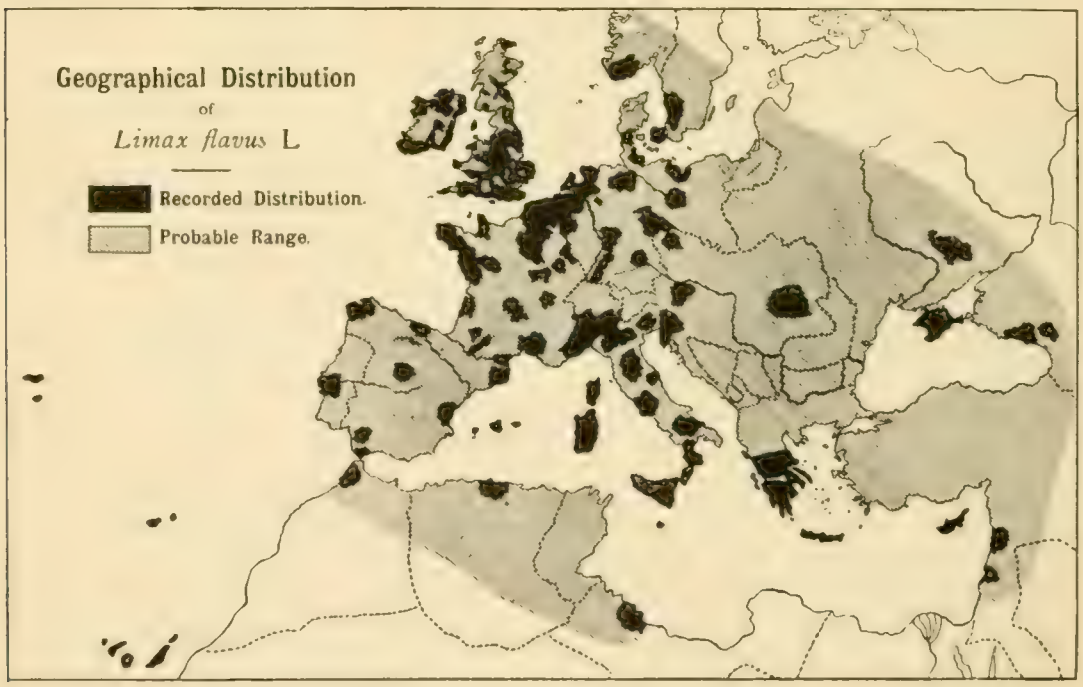


FIG. 101.

ENGLAND AND WALES.

Channel Isles—In Guernsey & Sark, but not commonly (Cooke & Gwatkin, Q.J.C., 1878, i., p. 322). Jersey, Lukis (Ansted's Channel Isles, 1862).

PENINSULA.

Cornwall W.—Phillack, near Hayle, Oct. 1884 ! Miss S. Hockin. Var. *flavescens*, Scilly Isles, Aug. 1890! Rev. E. Dale Roberts.

Devon S.—A specimen in the British Museum, from Dr. Leach, labelled "Plymouth" (T. D. A. Cockerell, 1891). About Exeter, but not so abundant as *L. maximus* (Parfitt, Nat., 1854, p. 150). Var. *grisea*, Topsham, Aug. 1892, L. E. Adams.

Devon N.—Enumerated in Besley's Handbook for North Devon, 1867, p. 124.

Somerset S.—Bridgwater, Aug. 1884! W. Vinson.

Somerset N.—Type and sub-var. *grisea*, Bath, June, 1884! C. J. Waterfall.

CHANNEL.

Dorset—Abundant, Glanville's Wootton (C. W. Dale, Hist. of Glanville's Wootton, 1878, p. 334). Weymouth (Damon's Geol. Dorset, 1884, p. 234).

Isle of Wight—Steephill, A.J.H. (Venables' Guide to Isle of Wight, 1860, p. 462).

Hants S.—Common, Christchurch! also found at Mudeford! C. Ashford, 1883. Ditcham wood, June 1896, C. E. Wright.

Hants N.—Preston Candover, July 1884! H. P. Fitzgerald.

Sussex E.—Ditch side, near Priory, Lewes (W. C. Unwin, Nat., 1853, p. 54). East Grinstead, E. Saunders. Near Hailsham (Harting, Zool., March 1878, p. 86). Eastbourne, Battle and Kingston (J. H. A. Jenner, Rep. Eastb. Nat. Hist. Soc., 1880).

Sussex W.—Occasionally at Chichester, Cowfold, and Henfield, W. Borrer; at Harting, Weaver & J. E. Harting; Brighton, Merrifield (Harting, Zool., 1878, p. 86). Garden, Ratham, June 1884! W. Jeffery.

THAMES.

Kent E.—Margate, April 1883! T. D. A. Cockerell. Faversham, Sept. 1884! Miss Fairbrass. Common at Folkestone, Sept. 1886! C. Oldham.

Kent W.—Type and var. *virescens*, Chislehurst, May 1885! T. D. A. Cockerell. Garden, Deptford, June 1886! A. J. Jenkins. Edenbridge, Feb. 1898! A. Leicester.

Surrey—Croydon (K. McKean's Croydon List, 1883). Wandsworth, June 1885! S. C. Cockerell. Limpsfield (W. M. Webb, Sc. Goss., June 1887). South Norwood, Haslemere, and Shottermill (C. Pannell, jr., J. of C., July 1903). Sutton, Oct. 1885! F. G. Fenn. Var. *flavescens* and var. *antiquorum*, labelled "Cobham, Dr. Leach," in British Museum (T. D. A. Cockerell, 1891).

Essex S.—Gardens, Barking Side, Wanstead (Crouch, Essex Nat., 1891, p. 209).

Essex N.—Common everywhere (H. Laver, Colchester List, 1882, p. 93).

Herts.—Hitchin, plentiful, Aug. 1873, C. Ashford. Exceedingly abundant in the old palace of the Saxon kings, Kingsbury, St. Albans, Sept. 1884! J. Hopkinson.

Middlesex—Acton, under logs, Aug. 1884! T. D. A. Cockerell. Bedford Park, March 1885! S. C. Cockerell. Shells labelled "Islington, E. A. Smith," in Brit. Mus. Hampstead, June 1888, H. W. Kew. Var. *flavescens*, Muswell hill, Highgate, June 1889! (H. W. Kew, Nat., Apl. 1889). Var. *suffusa*, Ealing, May 1885! S. C. Cockerell.

Oxford—Common in cellars, Oxford (J. F. Whiteaves' Oxford list, 1857, p. 5). Rather common in cellars, Banbury (R. H. Stretch, Zool., 1855, p. 4541).

Bucks.—Garden, Aston-Clinton (A. Leicester, J. of Conch., July 1902, p. 216).

ANGLIA.

Suffolk E.—Blaxhall, July 1885! G. T. Rope. Exceedingly common at Woodbridge, May 1886! S. Spencer Pearce. Mendlesham, Brockford and Ipswich (Mayfield, J. of Conch., April 1903, p. 295).

Norfolk E.—Norwich, in gardens and cellars (Bridgman, Zool., 1850, p. 2742).

Norfolk W.—Lynn, Aug. 1886, C. B. Plowright.

Cambridge—Whittlesea (Bellars, Brit. Shells, 1858). Near Cambridge, June 1886! B. Tomlin. Cambridge (L. Jenyns, Loudon's Mag., Nov. 1831, p. 538).

Bedford—Luton, Aug. 1885! J. Saunders.

Northampton—Peterborough (Bellars, Brit. Shells, 1858). Cellar, Northampton (Adams, Proc. Northants N.H. Soc., 1893). Fletton (Nicholls, J. of C., Apl. 1884).

SEVERN.

Gloucester E.—Stroud, Oct. 1883! E. J. Elliott.

Gloucester W.—Common in gardens, Bristol (E. C. Jellie, Nat., 1867, p. 148).

Monmouth—Common in Monmouthshire (E. J. Lowe, 1885).

Worcester—Sparkbrook, Birmingham (Proc. Birm. Nat. Hist. Soc., 1869, p. 108). Moseley, Oct. 1884! J. Madison. Worcester, Oct. 1886! H. Milnes. Cellars in Stourport (J. W. Williams, J. of Conch., vi., p. 112).

Warwick—Belgrave street and Digbeth, Birmingham, April 1867! W. Nelson. Garden, Sutton Coldfield, 1899, H. Overton. Var. *rufescens*, garden, Ingon Grange, Stratford-on-Avon, Sept. 1884! R. J. Attye. Cellar, Edgbaston, July 1898 (W. E. Collinge, J. of Mal., Dec. 1898, p. 16).

Stafford—Sub-var. *grisea* and type, Stafford, Dec. 1886! L. E. Adams. Stone, E. D. Bostock; Cheadle! (J. R. B. Masefield, Moll. Staff., 1902, p. 6). Walsall, 1897, H. Overton. Handsworth (Tye, Q.J.C., 1875, p. 68).

Salop—Oswestry, June 1885! B. Hudson.

SOUTH WALES.

Glamorgan—Cardiff (Wotton, Brit. Ass. Handbk., 1891, p. 182). Common about Swansea, 1901, H. Rowland Wakefield.

Pembroke—Pembroke, June 1885! Mrs. Trayler. Tenby, Nov. 1887! C. Jefferys.

NORTH WALES.

Montgomery—Rather plentiful and well distributed; Gungrog Hall, near Welshpool, M. C. Jones! (J. Bickerton Morgan, Montgomery Moll., 1888, p. 232).

Carnarvon—Conway Castle, Jan. 1888! L. E. Adams.

TRENT.

Lincoln N.—Wall, Lincoln road, Louth, April 1886 and May 1903! H. W. Kew. Alford, June 1890! J. E. Mason.

Leicester—Common in town cellars, Leicester (Quilter, Moll. Leic., 1888); cellar, Market street, Leicester, Oct. 1886! H. E. Quilter.

Notts.—Cellars, Highfield House, and in Nottingham (Lowe, Notts. List, 1853). Pleasley vale; Attenborough, and railway embankment, Lenton, 1883, C. T. Musson. Tuxford, June 1884! W. A. Gain. Corporation gardens, Wells road, Nottingham, July 1888! G. W. Mellors; Beech Avenue, Nottingham, Feb. 1885. B. Sturges Dodd. Cellar, Farnsfield, Oct. 1892! and var. *flavescens*, Oxton, Sept. 1892! C. Oldham.

Derby—Matlock, 1884, H. E. Craven. Repton, H. Milnes.

MERSEY.

Cheshire—Chester (Bellars, Brit. Shells, 1858). Holmes Chapel, Nov. 1896! Alderley Edge, July 1898! and Sale, Sept. 1892! C. Oldham.

Lancashire S.—Warrington (Bellars, Brit. Shells, 1858). Rainhill, Sept. 1885, T. D. A. Cockerell. Pendlebury and Moorside, R. Standen (Melvill, Brit. Assoc. Hdbk.), Southport (McNicholl, 1859, p. 146). Cellars, Manchester, R. D. Darbishire. Var. *rufescens*, Knowsley, Liverpool (W. E. Collinge, J. of Mal., 1893, p. 148).

Lancashire Mid—Abundant in fernery, Avenham lane, Preston, June 1888, and var. *rufescens*, timber-yard, Avenham lane, Preston, Feb. 1889! W. H. Heathcote.

HUMBER.

York S.E.—Common in cellars, Hornsea (J. D. Butterell, J. of Conch., Jan. 1881). Newport, near Staddlethorpe, abundant in garden, Aug. 1883! T. K. Skipwith. Abundant in garden, Westwood, Beverley, Sept. 1884! J. D. Butterell.

York N.E.—Yards and cellars, Redcar and Coatham, Aug. 1886! B. Hudson. Kirkleatham, Sept. 1886! W. D. R. Old walls, Bagdale and Boghole, Whitby, July 1883! H. Pollard. Occasionally in cellars, Thirsk (J. H. Davies, Nat., 1855, p. 134). Scarborough, W. Bean (Theakston's Guide to Scarborough, 1871, p. 176). Bootham School, York (R. M. Christy, Zool., 1881, p. 242). The typical form, var. *virescens* and var. *colubrina*, South Stockton, Dec. 1884! B. Hudson.

York S.W.—Barnsley, April 1893! F. Batley. Near Tarn Dam, Keighley, Feb. 1868! Cellars, Saltaire, Dec. 1888! J. Beanland. Warehouse, Pine street, Bradford, Oct. 1882! H. T. Soppitt. Dewsbury, Sept. 1885! P. F. Lee. Elland, April 1903, J. E. Crowther. Wakefield, Joseph Wilcock. Lofthouse, Sept. 1887, G. Roberts. Huddersfield, in damp cellars, etc., G. H. Parke.

York Mid W.—Cellars and kitchens, Leeds! Rennie Crags, Birstwith (Walker, J. of C., Jan. 1882). Pateley Bridge, March 1884! W. Storey. Boston Spa, common, 1884, John Emmett. Harrogate and Knaresborough (F. R. Fitzgerald, J. of C., Jan. 1889). Ingleton, common (W. E. Collinge, Nat., Apr. 1890).

York N.W.—Var. *rufescens*, Bowes Castle, abundant, Aug. 1903! T. Sheppard.

TYNE.

Durham—Sunderland, R. Howse (Alder's Cat. Mollusca, 1848, p. 125). South Shields, Nov. 1884! R. Howse.

Northumberland S.—Not common in cellars, Newcastle (Alder, Cat. Moll., 1848).

LAKES.

Isle of Man—Very common and fine on walls about Port Erin, Jan. 1880, L. E. Adams. Douglas! and Castletown, Aug. 1894, F. Taylor.

SCOTLAND. *WEST LOWLANDS.*

Kirkcudbright—Common in my cellars, Maxwelltown, July 1891! R. Service.

Renfrew—Type and sub-var. *grisea*, abundant about Scott's sugar refinery, Greenock, April 1886! T. Scott.

EAST LOWLANDS.

Peebles—West Linton, Sept. 1893, W. Turner.

Haddington—Balgone, Jan. 1896, W. Evans.

Linlithgow—Caribber Glen, Feb. 1898, and Dalmeny Park, Oct. 1902, W. Evans.

Berwick—In wine cellars, Berwick (G. Johnston, Proc. Berw. Nat. Club, 1838, p. 154). Near Eyemouth, Sept. 1895! W. Evans.

Edinburgh—Garden, 14, Inverleith Row, Edinburgh, Oct. 1888! W. D. R. Duddingston Loch, May 1894; Vogrie Glen, Feb. 1897; and Arniston, June 1902, W. Evans.

EAST HIGHLANDS.

Fife and Kinross—Craill, Aug. 1890! Kilconquhar, Sept. 1893; Loch Leven, June 1894; and Loch Gelly, May 1895, W. Evans.

Perth S.—Dollar, and Wharry Glen, Bridge of Allan, Feb. 1898, W. Evans.

Aberdeen S.—Under stones and by houses (J. Taylor, Zool., 1853, p. 3853).

Elgin—Cellars and other damp places in the province of Moray (G. Gordon, Zool., 1854, p. 4453). Var. *flavescens*, South College, Elgin, Dec. 1890! G. Gordon.

NORTH HIGHLANDS.

Caithness—Wick and other places (Peach, Roy. Phys. Soc. Edin., 1864).

IRELAND. *ULSTER.*

Antrim—Belfast (Thompson, Ann. and Mag. N.H., 1840, p. 18). Rathlin Island, in wood by the church, May 1898, L. E. Adams.

Tyrone—Strabane, June 1889, A. H. Delap.

Donegal—About Lifford, June 1889, A. H. Delap.

LEINSTER.

Louth—Piperstown, Oct. 1882! Miss S. Smith.

Dublin—On walls near Booterstown and Blackrock (Walpole, Zool., 1853, p. 4022). Kingstown, June 1886! W. F. de Vismes Kane. Abundant in cellars, etc., Leeson Park, and in Dublin city; Howth, April 1887! Raheny, Aug. 1890, Killakee, Dublin Mountains, Oct. 1890, and Botanic Gardens, Glasnevin, Nov. 1890, R. F. Scharff.

Wicklow—Belmont demesne, near Greystones, July 1891, R. F. Scharff.

Wexford—Kilmanock, New Ross, March 1888! G. Barrett-Hamilton.

CONNAUGHT.

Sligo—Infests houses and bathing lodges, Enniskrone, April 1889! and said to be numerous at Glen Lodge, near Ballina (A. Warren, Irish Nat., Sept. 1892, p. 126).

Mayo W.—Black Rock Lighthouse, 1890! R. Widdicombe.

MUNSTER.

Tipperary N.—Finnoe (E. Waller, N.H. Review, Apr. 1854, p. 87).

Tipperary S.—Glenconnor, April 1888, and Clonmel, June 1886, A. H. Delap.

Waterford—Near Waterford, Sept. 1883! J. H. Salter.

Cork N.—Garden, Youghal, R. Ball (Thompson, Ann. & Mag. N.H., 1840, p. 18).

Cork S.—Carrigaline, May 1888! Vismes Kane. Blarney, Sept. 1898, L. E. Adams.

Kerry—Rossbeigh, April 1888, A. H. Delap. Sparingly at Killarney, Sept. 1898 (Stubbs & Adams, Irish Nat., Nov. 1898).

GERMANY.

Clessin describes *Limax flavus* as inhabiting the whole of Germany, and records have been made for Baden, Bavaria, Brandenburg, Holstein, Nassau, Oldenburg, Pomerania, Saxony, Schleswig, Silesia, and Wurtemburg.

NETHERLANDS.

Holland—The Hague (R. J. Maitland, Nachrichtsbl., 1869, p. 163).

Belgium—(Colbeau, Mal. Belg., 1859).

FRANCE.

According to Moquin-Tandon this species is found throughout France. It has been recorded from the Agenais, Ain, Aisne, Alpes Maritimes, Ariège, Champagne Meridionale, Côte d'Or, Finistère, Gard, Gers, Gironde, Haute Garonne, Haute Loire, Hérault, Isère, Loire Inférieure, Manche, Maine et Loire, Meurthe, Morbihan, Moselle, Nièvre, Nord, Oise, Pas de Calais, Puy-de-Dôme, Pyrénées Orientales, the Quercy, Rhone, Seine, Seine et Marne, Somme, Vendée, and Corsica.

SWITZERLAND.

Clessin says probably found throughout, but no definite records have been seen.

ITALY.

Recorded by Simroth and others for North, Mid, and Southern Italy, also for Sicily, Sardinia, and Malta. The greatest altitude it attains in Italy is said to be about 2,800 feet at Bobbio in Piedmont.

AUSTRO-HUNGARY.

Clessin says probably found throughout the region, and although Simroth cites it for Hungary, the only available definite record is for Gorz on the Adriatic coast.

SPAIN AND PORTUGAL.

Spain—Recorded from Madrid in New Castile; Santiago in Galicia; Santander in Old Castile; Gibraltar and Seville in Andalusia; also for Valencia, Catalonia, and the Balearic Isles.

Portugal—Lisbon (Simroth, Nacktschn. Portug.-Azor., 1891, p. 279).

GREECE.

Probably widely dispersed in Greece, and has been reported from Athens, Patras, Prevesa, and from the Ionian Islands, Crete, Chios, etc.

SCANDINAVIA.

South Scandinavia—(Jordan, Binnenmoll., 1883); cited also by Grateloup for Norway and province of Skane in South Sweden.

Denmark—Copenhagen (Malm, Skand. Limac., 1878, p. 65).

RUSSIA.

Has only been reported as yet from the southern provinces at Lebedin, Achtyrka, and Bogoduchow in Kharkov; Sebastopol, Theodosia, and other localities in the Crimea, Suanetien, Kutais, and Lenkoran in Mingrelia, and Suchum in Abchasia.

NORTH AFRICA AND ASIA MINOR.

Morocco—Tangiers, T. D. A. Cockerell in litt., 1891.

Algeria—*L. deshayesi* Bourg., Cherchell (Bourg., op. cit.). *L. campanyoi*, Algiers (Lallemant, Moll. Alger, 1881, p. 2).

Tripoli—Grateloup (Dist. Geog. Limac., 1855).

Asia Minor—Sinope, Trebizonde, Beyrout, Haiffa, the Isle of Cyprus, etc.

ATLANTIC ISLES.

Azores—S. Miguel, in shady gardens about Ponta Delgada and Villafranca (Wollaston, Test. Atl., 1878, p. 11).

Madeira—Widely distributed and found occasionally at the Val, near Funchal, at Praia Bay, in the Curral das Freiras, etc.; also found by Rev. R. Boog Watson in the north of the island.

St. Helena—Specimens of sub-var. *maculata* Kal., in British Museum, from J. C. Melliss (T. D. A. Cockerell in litt., 1891).

JAPAN.

Simroth gives *L. flavus* as occurring in Hondo and the more southerly islands of Japan (Nacktschn. Portug.-Azor., 1891, p. 308).

NEARCTIC REGION.

According to Binney, it probably inhabits all the cities of the sea-coast and their vicinage, and some of the cities of the interior, and has been actually reported from

Maine—Occurs rarely at Portland (Morse, Pulm. Maine, 1864, p. 7).

Massachusetts—Numerous in garden, New Bedford (Thomson, J. of Conch., Oct. 1885); Boston and Cambridge (Binney, L. and F.W. Shells N. Amer., 1869, p. 61).

New Jersey—Cellar, Burlington (Binney, Proc. Acad. Nat. Sci. Philad., 1875, p. 173); Gutenberg (H. Prime, 1885).

New York—New York (Binney, L. and F.W. Shells of N. Amer., 1869, p. 61). Riverdale and Huntington, Long Island, H. Prime, 1885. Onondago Co., general, W. M. Beauchamp, 1885. Monroe Co. (J. Walton, Nautilus, 1898, p. 133). Commoner than *L. maximus* at Cayuga Lake Valley (N. Banks, Nautilus, April 1892).

Maryland—Baltimore (Binney, L. and F.W. Shells of N. Amer., 1869, p. 61).

Virginia—Richmond, University of Virginia and other cities (Binney, op. cit.,).

Pennsylvania—York, H. Prime, Oct. 1885. West Chester, Chester Co., W. D. Hartmann, Sept. 1885. Greenhouses and lily ponds, Lincoln Park, Philadelphia (F. C. Baker, Nautilus, Sept. 1901, p. 59).

District of Columbia—Washington (T. D. A. Cockerell, 1891).

Georgia—Athens and Savannah (Binney, Man. Amer. Land Shells, 1885, p. 452).

South Carolina—Graniteville and Charleston (Binney, op. cit., p. 452).

NEOTROPICAL REGION.

Brazil—Porto Alegre and Jaguarao (Heynemann, J. D. M. G., 1885, p. 275).

Chili—*L. chilensis* Gay (Heynemann, op. cit.).

Argentina—Buenos Ayres (M. Strobel, Act. Soc. Sc. Nat. Milan, 1868).

ETHIOPIAN REGION.

Natal—Pietermaritzburg (Melvill & Ponsonby, Proc. Mal. Soc., Dec. 1898, p. 172).

Seychelles—(H. Simroth, Nacktschn. Portug.-Azor., 1891, p. 308).

AUSTRALASIAN REGION.

New South Wales—Sydney (E. A. Smith, Proc. Zool. Soc., 1884, p. 272); Gladesville and Summer Hill, J. Brazier; Inverell, Duncan; and on walls of a well, Tamworth (C. T. Musson, Journ. Linn. Soc. N.S.W., 1890, p. 892).

Victoria—Benalla, J. Brazier (C. T. Musson, op. cit.). Var. *breckworthiana*, Breckworth (Lehmann, op. cit.). *L. bicolor*, Sydney (Selenka, Mal. Bl., xii., p. 105).

Queensland—Brisbane, C. Hedley (C. T. Musson, op. cit.).

Tasmania—Launceston, C. Hedley (C. T. Musson, op. cit.).

New Zealand—Dunedin and Greymouth in South Island, Capt. Hutton (C. T. Musson, op. cit.); North Island (Heynemann, op. cit., 1885, p. 305).

New Hebrides—Sub-var. *maculata*, specimens in British Museum, from Rev. Wyatt Gill (T. D. A. Cockerell, in litt., 1891).

Cook's Islands—Sub-var. *maculata*, Rarotonga, specimens in British Museum, from Rev. Wyatt Gill (T. D. A. Cockerell, in litt., 1891).

Distribution of *Limax flavus* L.

In the Counties and Vice-Counties of the British Isles.

ENGLAND AND WALES.

Channel Isles

PENINSULA
1 Cornwall W.
2 Cornwall E.
3 Devon S.
4 Devon N.
5 Somerset S.
6 Somerset N.

CHANNEL
7 Wilts N.
8 Wilts S.
9 Dorset
10 Isle of Wight
11 Hants S.
12 Hants N.
13 Sussex W.
14 Sussex E.

THAMES
15 Kent E.
16 Kent W.
17 Surrey
18 Essex S.
19 Essex N.
20 Herts.
21 Middlesex
22 Berks.
23 Oxford
24 Bucks.

ANGLIA
25 Suffolk E.
26 Suffolk W.
27 Norfolk E.
28 Norfolk W.
29 Cambridge
30 Bedford
31 Hunts.
32 Northampton

SEVERN
33 Gloucester E.
34 Gloucester W
35 Monmouth
36 Hereford
37 Worcester
38 Warwick
39 Stafford
40 Salop

SOUTH WALES
41 Glamorgan
42 Brecon
43 Radnor
44 Carmarthen
45 Pembroke
46 Cardigan

NORTH WALES
47 Montgomery
48 Merioneth
49 Carnarvon
50 Denbigh
51 Flint
52 Anglesey

TRENT
53 Lincoln S.
54 Lincoln N.
55 Leic. & Rutld.
56 Notts.
57 Derby

MERSEY
58 Cheshire
59 Lancashire S.
60 Lancashire Mid

HUMBER
61 S.E. York
62 N.E. York
63 S.W. York
64 Mid W. York
65 N.W. York

TYNE
66 Durham
67 Northumb. S.

LAKES
68 Cheviotland
69 Westmorland and L. Lancs.
70 Cumberland
71 Isle of Man

SCOTLAND.

W. LOWLANDS
72 Dumfries
73 Kirkcudbright
74 Wigtown
75 Ayr
76 Renfrew
77 Lanark

E. LOWLANDS
78 Peebles
79 Selkirk
80 Roxburgh
81 Berwick
82 Haddington
83 Edinburgh
84 Linlithgow

E. HIGHLANDS
85 Fife & Kinross
86 Stirling
87 Perth S. & Clkn
88 Mid Perth
89 Perth N.
90 Forfar
91 Kincardine
92 Aberdeen S.

E. HIGHLANDS
93 Aberdeen N.
94 Banff
95 Elgin
96 Easterness

W. HIGHLANDS
97 Westerness
98 Main Argyle
99 Dumbarton
100 Clyde Isles
101 Cantire
102 Ebudes S.
103 Ebudes Mid
104 Ebudes N

N. HIGHLANDS
105 Ross W.
106 Ross E.
107 Sutherland E.
108 Sutherland W.
109 Caithness

NORTH ISLES
110 Hebrides
111 Orkneys
112 Shetlands

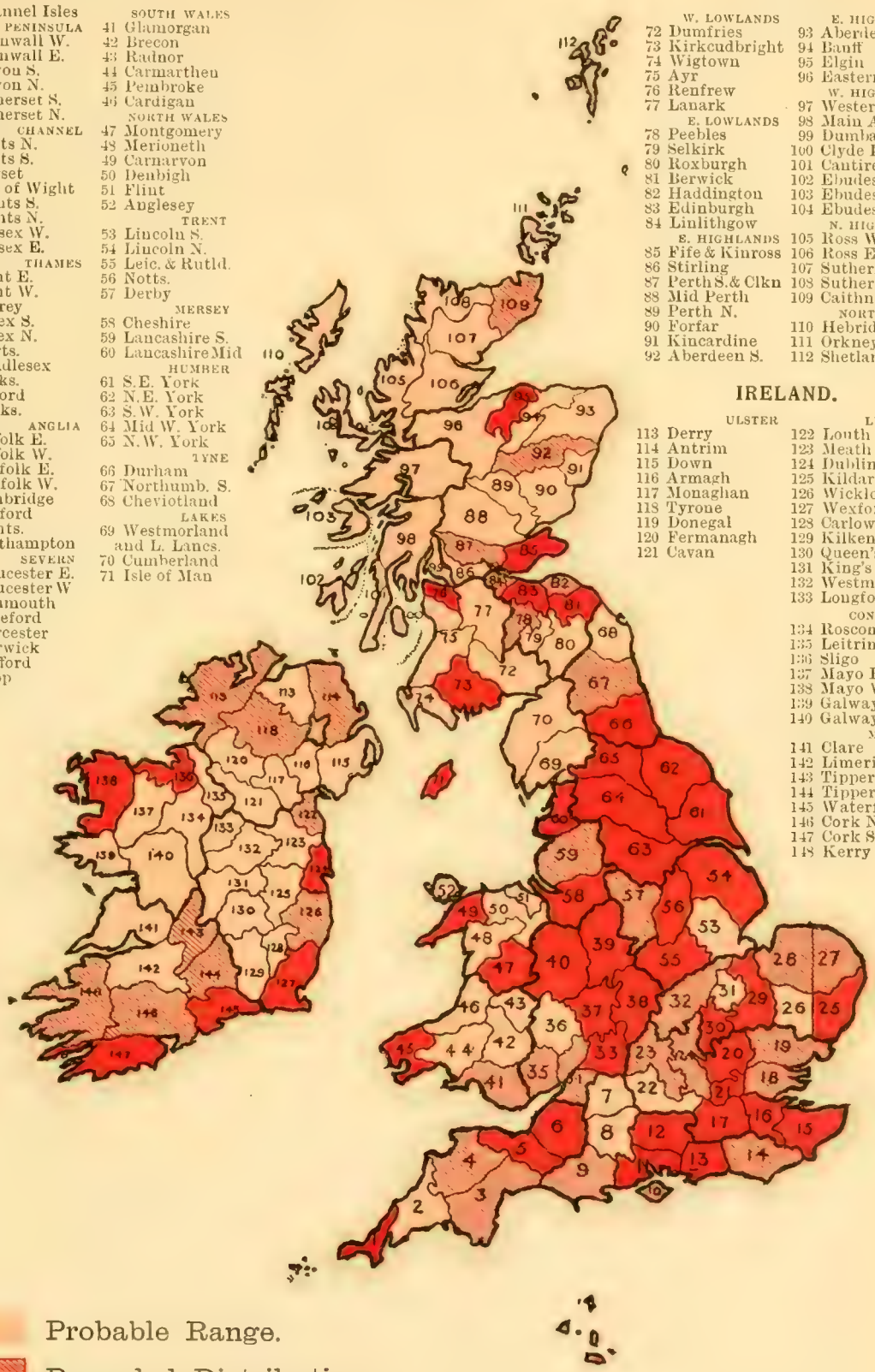
IRELAND.

ULSTER
113 Derry
114 Antrim
115 Down
116 Armagh
117 Monaghan
118 Tyrone
119 Donegal
120 Fermanagh
121 Cavan

LEINSTER
122 Louth
123 Meath
124 Dublin
125 Kildare
126 Wicklow
127 Wexford
128 Carlow
129 Kilkenny
130 Queen's Co.
131 King's Co.
132 Westmeath
133 Longford

CONNAUGHT
134 Roscommon
135 Leitrim
136 Sligo
137 Mayo E.
138 Mayo W.
139 Galway W.
140 Galway E.

MUNSTER
141 Clare
142 Limerick
143 Tipperary N.
144 Tipperary S
145 Waterford
146 Cork N.
147 Cork S.
148 Kerry



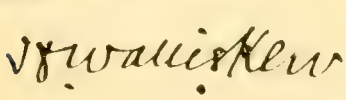
Probable Range.

Recorded Distribution.

Distribution verified by the Authors.

Limax arborum Bouchard-Chantereaux.

1774 **Limax** *marginatus* Müller, Verm. Hist., ii., p. 10, No. 206.
1779 — *scopulorum* Fabricius, Reise Norwegen, p. 298.
1822 — *cinereus* var. *β* Nilsson, Hist. Moll. Sveciæ, p. 7.
1833 — *gagates* Boubée, Bull. Hist. Nat. Franç., p. 13.
1836 — *salicium* Bouillet, Cat. Moll. Auvergne, p. 18.
1837 — *limbatus* Held, Isis, p. 303.
1838 — **arborum** Bouch.-Chant., Moll. Pas-de-Calais, p. 28.
1843 — *glaucus* and *arboreus* Clarke, Ann. and Mag. N.H., p. 334, pl. 11, ff. 4-10.
1848 — *livonicus* Schrenk, Land u. Susswass. Livlands, p. 142.
1852 — *marginatus* Baudon, Cat. Moll. Oise, p. 6.
1852 — *scandens* Normand, Desc. Limac. Nouv., p. 6.
1856 — *sylvaticus* Goldfuss, Rheinpr., p. 65, pl. 3, f. 8.
1857 — *arboreum* Gray, Turton's Manual, p. 82.
1870 — *bettonii* Sordelli, Atti Soc. Ital. Sci. Nat., p. 251.
1871 — *agrestis* var. *saxorum* Baudon, Mém. Limac. Oise, p. 19, pl, 4, ff. 10-12.
1877 — *altilis* Fischer, Journ. de Conch., p. 49.
1868 *Lehmannia marginata* Malm, Skand. Limac., p. 83.
1876 *Amalia marginata* Fischer, Journ. de Conch., p. 53.
1880 — *marginata* var. *mongianensis* Paulucci, Fauna Mal. Calabria, p. 23.



HISTORY.—*Limax arborum* (*arborum*, belonging to trees) has attracted the attention of some of the earliest observers, and has, therefore, received a variety of names, but it was not until 1838 when Bouchard-Chantereaux unmistakably described its peculiarities that a name was applied to it with certainty.

Though it is probable that previous authors had this slug before them, their descriptions are not such as to remove all doubt, and have therefore given rise to much controversy, so that it has been deemed advisable to adopt the first name about which no difference of opinion has arisen.

The *Limax marginatus* of Müller, the *L. scopulorum* of Fabricius, *L. sylvestris* of Scopoli, *L. gagates* of Boubée, *L. salicium* of Bouillet, and *L. limbatus* of Held, according to many of the best authorities, are all probably referable to *Limax arborum*, but the margin of doubt that exists precludes the use of any of these names for the species.

Though classified with *L. flavus* mainly on account of the exact similarity of their alimentary systems, yet this location is not altogether satisfactory, as the sexual organs demonstrate a close relationship with *Agriolimax*, from the Caucasian stock of which group Simroth believes this species to have been derived, the connecting links being still existent in Abyssinia; *Limax arborum* therefore connects the Agriolimaces with the typical Limaces, partaking to some extent of the peculiarities of each.

With this species, so especially identified with the power of spinning mucous threads, we have associated Mr. H. Wallis Kew, F.Z.S., of Hornsey, London, who has devoted so much time and ability to the investigation of the phenomenon of thread-spinning in mollusks as well as other animals.

Diagnosis.—*Limax arborum* is distinguished from other Limaces by its remarkably gelatinous and transparent aspect, due to its great capacity for the absorption of water. It is also readily separable from *L. maximus*, with young individuals of which it is sometimes confounded, by the distinct lateral banding upon the shield, and by being incapable of uplifting and reflecting the anterior part of the mantle in response to irritation.

INTERNALLY, the animal is distinguished by a horn-shaped flagellum to the penis-sheath, and an appendix or cœcum to the rectum, features not possessed by *Limax maximus*, with which it is most liable to be confused.

Description.—ANIMAL moderately long and slender with a very soft and gelatinous BODY, of a glaucous-grey, but sometimes of a yellow or rufous tint, or even entirely black, usually with a paler mid-dorsal line, bordered at each side by an ill-defined darker longitudinal band, which gradually attenuates as it approaches the slightly-keeled tail; towards the FOOT there are indications of a line representative of the outer band of the true Limaces; HEAD similar in colour, but paler than the rest of the body; FOOT distinctly tripartite and white; SHIELD moderately large, rounded in front, and somewhat acutely pointed behind, concentrically striate around a sub-posterior nucleus, and marked laterally by a black band on each side, which bends inwards at the rear, and forms the so-called lyre-shaped marking; midway there is also often a greyish shade, which gives the aspect of a longitudinally trifasciate shield. Length usually about 75 mill., but sometimes much larger. MUCUS colourless and very iridescent.

SHELL ovaliform, somewhat wider at the apical end, slightly convex, very white, glistening, and iridescent above, with the lines of increase close, sharp, and well defined, concave and somewhat dull beneath.

Length, 4 mill.; width, $2\frac{3}{4}$ mill.

FIG. 106.—Internal shell of *Limax arborum*, × 5.

The shell of *L. arborum* is, however, exceptionally variable both in size and substance; examples have been recorded 7-8 mill. in length, and the thickness varies from a delicate plate to an almost cubical calcareous mass, which in some cases ruptures the mantle and protrudes through the skin.

INTERNALLY, the BODY CAVITY is darkly pigmented, varying from violet to black, the colouring being more conspicuous towards the tail, where even the deeper tissues are tinged. The fine membrane investing the visceral mass is rich in sooty-black pigment cells, but in the anterior part of the body a calcareous netting predominates.

The NERVOUS SYSTEM shows the buccal and supra-œsophageal ganglia to be markedly bilobed; the sub-œsophageal group is apparently formed of four ganglial masses intimately fused together. The dark pigment which pervades the body cavity of this species gives also a lilac tint not only to parts of the brain but even to some of the nerve sheaths; the OSPHRADIUM is distinguishable as a broad, flat fissure, with scarcely raised puffings, extending towards the left side; the OTOLITHS are very numerous, two to three hundred in each capsule, the prevailing form being oval with a central speck.

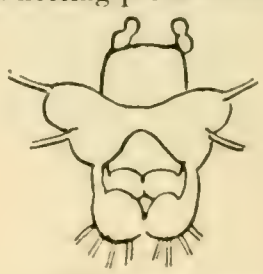


FIG. 107.—Nerve centres of *Limax arborum*, × 6.

The ALIMENTARY CANAL resembles very closely that of *L. flavus*; the SALIVARY GLANDS are small, somewhat triangular, and of a yellowish or whitish colour; the LIVER varies in colour from a bright golden brown to a dark olive or earthy brown; the KIDNEY is also similar to that of *L. flavus*, except that it has a very large slime gland, which makes broad contact with the head of the ureter; the PULMONARY vessels are scarcely raised above the surface of the lung wall.

The REPRODUCTIVE ORGANS have more affinity with those of *Agriolimax agrestis* than with those of *Limax flavus*; the OVOTESTIS is in two small roundish dark-brown lobes; the DUCT, at first straight and slender, becoming moderately convoluted as it approaches the large, yellow, and linguiform ALBUMEN GLAND, the tiny VESICULA SEMINALIS being preceded by a conspicuous enlargement; the OVISPERMATODUCT is more firmly united than in the preceding species; the SPERM-DUCT increasing in size downwards and abruptly rounded where the channels separate; VAS DEFERENS comparatively short, entering a lateral enlargement at end of penis-sheath; FREE-OVIDUCT cylindrical and bluish-white, its lower two-thirds invested with opaque, buff-coloured, and plaited glands, which extend to the atrium; PENIS-SHEATH short

and thick, with median inflation, cushioned with gelatinous matter, and possessing a white horn-shaped glandular appendage of variable length at its apex, but as the seminal element is transferred free, this flagellate slime-gland has nothing in common

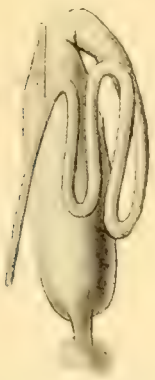


FIG. 108.—Alimentary canal of *Limax arborum* (somewhat enlarged).

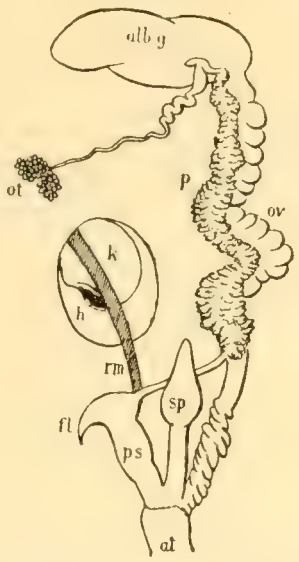


FIG. 110.—Penis-sheath of *Limax arborum* laid open, showing the internal structure (after Simroth).

fl. flagellum; *v.d.* vas deferens; *i.* internal projection.

FIG. 109.—Sexual organs of *Limax arborum*, × 2. *alb.g.* albumen gland; *at.* atrium; *fl.* flagellum; *h.* heart; *k.* kidney; *ot.* ovotestis; *ov.* oviduct; *p.* prostate; *p.s.* penis sheath; *r.m.* retractor muscle; *sp.* spermatheca.

with the flagellum of the *Helicidæ*, in which group it is concerned in the formation of the spermatophore; internally, the penis-sheath shows two prominent longitudinal muscles, and frequently a linguiform projection, which may serve as a sarcobelum.[1] The penis retractor is a powerful muscle, attached to the lung floor in front of the cephalic retractor; SPERMATHECA pyriform, and opening into the atrium.

The CEPHALIC RETRACTOR arises as usual from beneath the hind margin of the shield, and runs nearly half its length undivided; it then usually separates into three branches; the right and left TENTACULAR and the PHARYNGEAL muscles; the pharyngeal bifurcating soon after its separation. The retractor to the pharynx does not always separate from the main stem simultaneously with the tentacular branches, but may do so a little before or after the tentacular divarication.

The MANDIBLE or jaw is about a millimetre wide, not so convex as those of the allied species, of a yellowish brown colour, smooth and delicate in texture, with rounded ends, and with a very wide, slightly projecting and blunt median beak or rostrum.

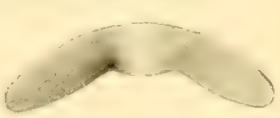


FIG. 111.—Mandible or jaw of *Limax arborum*, × 16. (Christchurch, Hants. S., C. Ashford).

The LINGUAL MEMBRANE in ordinary specimens is about four mill. long and two mill. wide, the transverse rows being arranged in the form of a well-defined printer's "brace"; the median row shows obscurely tridentate teeth, the mesocone exceptionally broad and strong, and the ectocones ill-defined and without perceptible cutting points; the lateral teeth are also remarkable for the well-marked mesocone and the indistinct side-cusps; the marginals are sinuate in shape, and at first distinctly unicuspid, but towards the outer rows an ectocone may be perceived on many of the teeth, the extreme marginals being, however, simply aculeate.

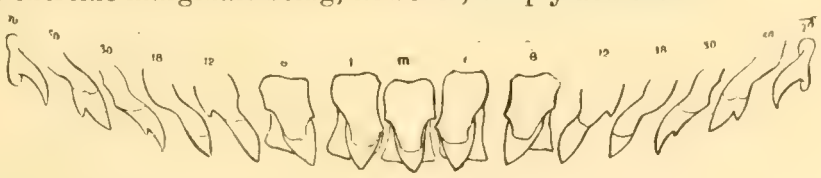


FIG. 112.—Representative denticles from a transverse row of the lingual teeth of *L. arborum*, × 120. The animal collected at Christchurch by Mr. C. Ashford, and the palate prepared by Mr. W. Moss.

The obliteration of the side-cutting points on the median and lateral teeth is an attribute of maturity, as the teeth of the young are, according to Miss Esmark, always provided with lateral points.

The formula of a Christchurch specimen is $\frac{63+10+1+10+63}{1\text{-}2\ \ 2\ \ 3\ \ 2\ \ 1\text{-}2} \times 105 = 15{,}435.$

1 Monog. i., p. 365, f. 667.

Reproduction and Development.—The act of conjugation, which is said to occur in the autumn and spring months, probably takes place during the night, and does not appear to have been carefully observed or recorded, as, except Mr. J. E. Daniels' casual remark that he has seen this species suspended in couples during the pairing season, like *L. maximus*, we have no particulars of the details of the act.

The eggs, which are very similar to those of *L. maximus*, are twenty to thirty in number, oval in shape, very transparent and elastic, about five mill. long and about four mill. in diameter, deposited singly or in clusters in the earth, under the bark of trees, amongst rotten wood, and other suitable places; they hatch in about a month's time, the young being very active, and usually of a reddish-violet or wine colour, with strong and well-defined banding on shield and body, and becoming adult towards the end of the first year.

Food and Habits.—Essentially an arboreal species, and though perhaps preferring beech trees on account of the wealth of cryptogamic growths upon their stems, has been also noticed to frequent the hornbeam, the walnut, the mountain ash, the alder, the elm, the willow, the ash, the apple, the crab, and occasionally has been found even on pine trees.

Though probably preferring trees, *L. arborum* also frequents rocks, walls, and a variety of other situations; Prof. E. Forbes records it as being found plentifully on bare rocks at an altitude of 1,500 feet on the Connor Cliffs, Dingle; while Dr. Scharff has received specimens from the Skelligs Rock, a large, naked rock, off the Kerry coast, on which there is neither tree nor bush, and which during westerly winds is entirely enveloped in a mist of spray from the huge Atlantic waves which beat over a great part of it, and Dr. Jeffreys found it under somewhat similar circumstances on the Outskerries, a remote cluster of islands of the Shetland group.

It has also been noticed by Mr. J. G. Milne living upon the heather and gorse in Western Mayo, and was seen by Dr. Scharff in county Cork feeding upon lichens in company with *Geomalacus maculosus*.

L. arborum is a hardy species and hybernates only during severe weather. It ascends to over 8,000 feet in the Alps, and in the Pyrénées is one of the characteristic species of the zone between 3,900 and 4,900 feet. In Scotland it has been found on Ben Lawers, in Perthshire, at an altitude of more than 3,000 feet; and in Yorkshire up to 1,800 feet on Buckden Pike, Wharfedale.

Though *L. arborum* during wet weather is extremely active in movement, especially when young, it clings very loosely when crawling, and often falls to the ground at the least touch. It is what is called a hygrometric species, and has a great capacity for the absorption of water, drinking it very greedily and absorbing it also by the skin, filling the body cavity with fluid, which imparts to it the peculiar transparent aspect that enables the internal organs to be perceived through the skin; this water reservoir is said to be a provision against drought, but the water store is exuded freely through the skin when the animal is irritated or touched.

In continued dry weather the reserve of moisture is gradually expended and the animal diminishes in size and loses its characteristic translucency. At such times the animals show a very gregarious habit, and many individuals, with the object of conserving their body moisture, may often be found huddled closely together in some sheltered nook or crevice, or they may retire deep into the earth or beneath the shelter of dead and decaying leaves, coming up to feed only during the night.

Although naturally of nocturnal or crepuscular habit, yet during or after showery weather the animals emerge from their retreats, indifferent as to the time of day, and ascend to the tops of the highest trees, afterwards resting immobile during the day in the cavities beneath the branches, the armpits as it were, or within the dense tufts of *Orthotrichum phyllanthemum* and other mosses with which the tree trunks are sometimes clothed.

Some individuals, however, may for a length of time remain contentedly within the sheltering cavities they frequent, and rest for a time partially or even wholly submerged in the accumulated water.

This species, though usually regarded as the mucus thread-spinner par excellence, does not really spin so well or so readily as *A. agrestis.*

According to Bouchard-Chantereaux, R. Standen, and others who have studied the subject, it can, however, especially when young, and when not gorged with food or overladen with moisture, spin well and easily, descending considerable distances without difficulty, and if necessary can reascend by the same thread.

As a consequence of its adaptation to rocks and trees, the staple food of the species has become changed from fungi to the cognate lichens, and, according to Simroth, although the contents of the stomach turn alcohol green, this is not due to leaves and vegetables, but to the colouring matter contained in the lichens. Malm, however, has seen it devouring the small fungoid growths growing upon diseased places on oaks, birch, and other trees, and many observers have stated that it also feeds upon the soft young growth of bark and decaying wood. In confinement they will on occasion prey upon each other, and Gain states that out of 185 different kinds of food, they eat fairly freely only of lettuce-stalk, turnip, and cooked onions, and that such mosses, lichens or fungi as he offered were left untouched.

Parasites and Enemies.—In addition to the enemies of slugs in general, *L. arborum* is, according to Fischer, liable to be attacked and destroyed by a species of *Carabus,* which tears open the skin with its mandibles and feeds upon the viscera.

It is also liable to be infested by an entozoan worm, which Van den Broeck discovered living within the vitelline sac of the embryo.

Fossil.—This species is reported from the Pleistocene beds of Moravia, by Spiridion Brusina, and by Mrs. McKenny Hughes from the same deposits at Barnwell Abbey in Cambridgeshire. Sandberger records it for Britain from the Lower Pleistocene freshwater bed at West Runton, Norfolk, and also from our Upper Pleistocene brick earths.

Variation.—*Limax arborum* is subjected to some amount of variation in the fundamental colour of the body, and also in the character and distinctness of the markings thereon.

According to Simroth the body markings are constituted by the presence of the inner, main, and outer bands, as in the true Limaces, but the outer band is usually missing, and the main band when present is generally represented by a more or less faintly indicated line.

The keel is very variable in its length and prominence, and is said to be most strongly developed in elevated or mountainous regions, where it may extend to almost four-fifths of the total length of the body; this peculiarity is invariably accompanied by the greater diffusion of the darker secondary colouring, which may extend to such a degree that the whole body becomes uniformly dark or even black, the slightly paler areas at the fore-part of the body being due in this as in other species to the lime plentifully deposited within the tissues of the body walls.

This darkening of the body would seem to be a response to the character of its habitat in the mountains or at the more extreme points of its geographical range, as it has been noticed in the northern and north-western parts of this country, in Transylvania, Portugal, and Italy. In the latter country the transition from the ordinary glaucous form to the uniformly dark variety can be traced as the mountains are ascended.

VARIATIONS IN COLOUR AND MARKINGS OF ANIMAL.

Var. **flava** Weinland, Weichth. Schwab. Alb., 1876, p. 27.

BODY and SHIELD greenish-yellow. Formula 000 000.

Though no remark is made in the description, it is probable that the lateral banding on the shield and the inner bands on the body will be faintly perceptible.

Wurtemburg—(Weinland, op. cit.).

Var. **glauca** Clarke, Ann. and Mag. Nat. Hist., 1843, p. 334, pl. 11.

ANIMAL of a pale bluish-grey colour, with a glaucous-shade, showing a slightly paler mid-dorsal line, margined on each side by an indistinct darker line; SHIELD with a dark lateral band on each side. Formula 001 100.

Surrey—A colony of the sea-green variety on an old oak in garden, Bramley hill, Croydon (K. McKean, Proc. Croydon Soc., 1883, p. 147).

Ireland—(B. J. Clarke, op. cit.). Killarney, Kerry, Sept. 1884, Howard Bendall.

Var. **subrufa** Le Comte, Bull. Soc. Mal. Belg., 1871, p. lxv.

Limax arborum var. *subrufa* Le Comte, op. cit.
Amalia marginata var. *mongianensis* Paulucci, Fauna Calabria, p. 1880.
Lehmannia marginata var. *pallens* Less. & Poll., Mon. Limac. Ital., 1882, p. 16.
Lehmannia marginata var. *requienii* Poll., Boll. Mus. Zool. Torino, 1896, p. 1.
Limax flavus var. *lineolatus* Collinge, Zool., April 1890, p. 145.

BODY colour yellow or ochreous, inner bands bordering the slightly paler keelline; SHIELD with darker lateral bands. Formula 001 100.

The var. **subrufa** s.str. has a rufous-yellow ground with a greenish shade, caudal end of body blackish; shield bands dark grey.

The sub-var. **mongianensis** is dull ochreous, fuscous-brown on the back, with paler dorsal-line; shield with black lateral bands, and clouded with fuscous-brown.

The sub-var. **requienii** is ochraceous, darker dorsally, with yellowish dorsal-line; shield with blackish lateral zones, and minutely spotted anteriorly and laterally.

The sub-var. **pallens** is pale, with a paler dorsal-line; shield faintly banded.

The sub-var. **lineolata** is yellowish, with an ashy-grey dorsal-line and dark-brown inner bands; shield with dark lateral bands; tentacles yellowish.

Oxford—Sub-var. *lineolata*, Nelthorpe, near Banbury (Collinge, op. cit.).

Norfolk E.—Sub-var. *pallens*, from near Norwich, in Br. Mus., T. D. A. Cockerell.

Gloucester E.—Sub-var. *pallens*, labelled "Cheltenham," specimens in British Museum (T. D. A. Cockerell).

Derby—Var. *subrufa*, Chapel-en-le-Frith, June 1897 ! C. Oldham.

York Mid W.—Var. *subrufa*, Mickley, Aug. 1889 ! W.D.R.

Aberdeen S.—Var. *subrufa*, Mony Musk Woods, Sept. 1886 ! C. B. Plowright.

France—Sub-var. *requienii*, Vizzavona, Corsica (Pollonera, op. cit.).

Belgium—Var. *subrufa*, plentiful, Bois-de-Lessines (Le Comte, op. cit.).

Italy—Sub-var. *mongianensis*, Monte Pecoraro, near Mongiana, Calabria (Paulucci, op. cit.). Sub-var. *pallens*, Valle d'Antigorio, Piedmont (Less. & Poll., op. cit.).

Var. **rosea** Van den Broeck, Annales Soc. Mal. Belg., 1870, p. 49.

Limax arborum var. *roseus* Van den Broeck, op. cit.
Limax arborum var. *coloratus* Van den Broeck, op. cit., p. 53.
Limax arborum var. *nemorosa* Baudon, Mém. Limac. Oise, 1871, p. 19, pl. 4, f. 10-12.
Limax agrestis var. *saxorum* Baudon, op. cit., p. 16, pl. 2, f. 1.
Limax altilis Fischer, J. de Conch., Jan. 1877, p. 49.

ANIMAL with main and inner bands more or less distinct; SHIELD with well-marked lateral band on each side. Formula 021 120.

The var. **rosea** s.str. has the ground colour rosy-white, becoming of a rufous brown on the back; inner band broad and well marked, and of a distinctly zig-zag pattern, bordered by a rosy-white line; main band repesented by an irregular and interrupted row of black spots; shield reddish-brown, paler than the back; the black lateral bands do not reach beyond the anterior third of its length; the left band is margined internally, and that of the right side externally, by a white line.

The sub-var. **colorata** has a whitish mid-dorsal line, inner band black or deep brown; main band dark brown, beset with little pale spots, very irregular and sinuate in general character, recalling the bands of *L. maximus* var. *serpentina*.

The sub-var. **nemorosa** has the ground colour reddish-grey, tinged with brown, mid dorsal line pale fawn, bordered by the deep brown inner band, main band slightly paler, a few whitish marks on the sides.

The **L. altilis** is, according to Dr. Baudon, identical with the var. *nemorosa*.

The sub-var. **saxorum** has a rufous ground, with well marked and regular black inner band, and broad black main band; shield with the black lateral bands broken up anteriorly into minute spots.

Dorset—Sub-var. *nemorosa*, Chideock, Aug. 1885 ! A. Belt.

Hants S.—Sub-var. *nemorosa*, Holmsley, Sept. 1885 ! Vinney Ridge, June 1887 ! and Wootton enclosure, C. Ashford. Hambledon, L. E. Adams (Adams & Woodward, Sci. Goss., March 1901, p. 301).

Oxford—Sub-var. *nemorosa*, specimens labelled "Oxford," from Dr. Norman, in British Museum (T. D. A. Cockerell).

Norfolk W.—Sub-var. *nemorosa*, Lynn, Sept. 1886 ! C. B. Plowright.

Merioneth—Sub-var. *nemorosa*, Bont-ddu, Dolgelly, Sept. 1886 ! F. G. Fenn.

Lake Lancashire—Sub-var. *nemorosa*, Coniston, Aug. 1886 ! W.D.R.

Stirling—Sub-var. *nemorosa*, Balmore, Sept. 1888 ! A. Shaw.

Main Argyle—Sub-var. *nemorosa*, Dunoon, Aug. 1886 ! W.D.R.

Clyde Isles—Sub-var. *nemorosa*, Barone, Bute, Aug. 1886 ! W.D.R.

Ross W.—Sub-var. *nemorosa*, Ullapool, Aug. 1886 ! A. Somerville.

Antrim—Sub-var. *nemorosa*, Cushendun, May 1886 ! S. A. Brenan.

Sligo—Sub-var. *nemorosa*, Collooney, Sept. 1885 ! W. F. de Vismes Kane.

Mayo W.—Sub-var. *nemorosa*, Enniscoe demesne, Crossmolina, Sept. 1885 ! J. G. Milne. Newport and Slievemore, Sept. 1888 (id., J. of Conch., Oct. 1891, p. 415).

Cork N.—Sub-var. *nemorosa*, Mallow, Nov. 1885 ! W. F. de Vismes Kane.

Kerry—Sub-var. *nemorosa*, Killarney, June 1885, W. F. de Vismes Kane.

France—Sub-var. *nemorosa* has been recorded from Bramepan in the Basses Pyrénées; from the forest of Hez in the Oise; from the woods at Saint Saulge in the Nièvre; and as *Limax altilis* from Val de Cauterets in the Hautes Pyrénées.

Belgium—Var. *rosea*, Rouge-Cloître, Brabant; var. *rosea* and sub-var. *colorata*, Roumont, Luxemburg (Van den Broeck, op. cit.).

Italy—Sub-var. *nemorosa*, Piedmont and Lombardy (Less. & Poll., op. cit.).

Var. **bettonii** Sordelli, Atti Soc. Ital. di Sci. Nat., 1871, p. 251.

Limax bettonii Sordelli, op. cit.
Limax arborum var. *decipiens* Cockerell, Sci. Gossip, 1886, p. 187.
Lehmannia marginata var. *obscurus* Esmark, J. of Conch., Oct. 1886, p. 102.
Limax arborum var. *carpaticus* Hazay, Jahrb. Deutsch. Mal. Ges., Feb. 1885, p. 23.

ANIMAL with inner and main bands fused together, but broken up by irregular pale spottings, simulating to some extent the markings of *L. flavus*; dorsal-line pale; SHIELD with lateral bands and a median dusky zone. Formula 0(21) (12)0.

The vars. **bettonii** s.st. and *decipiens* are characterized by the fusion of the inner and main bands, broken up, however, by irregular pale spots; dorsal zone whitish; shield with lateral bands and median zone brownish.

The var. **obscura** is described as hard and solid, with keel yellowish and dark greyish or yellowish-brown back; sides paler, and speckled with paler spots; the shield blackish brown, often with a handsome yellow margin.

The var. **carpatica** is obscurely maculate or marbled; keel line pale.

The var. **albomaculata** of Kreglinger may also belong here.

Cornwall W.—Var. *bettonii*, Phillack, Hayle, Oct. 1884 ! Miss Susan Hockin.

Cornwall E.—Var. *bettonii*, St. Columb, May 1885 ! W. Vinson.

Hants S.—Var. *bettonii*, Holmsley station, Sept. 1885 ! C. Ashford. Under felled timber, Wootton, in the New Forest, C. Ashford; Hambledon, L. E. Adams (Adams & Woodward, Sci. Goss., March 1901, p. 301).

Anglesea—Var. *bettonii*, Llanfaes, in woods near village, Sept. 1886 ! J. G. Milne.

Norfolk E.—Var. *bettonii*, from Norwich, in Brit. Mus., T. D. A. Cockerell.

York N.E.—Var. *bettonii*, Saltburn wood, Sept. 1886 ! W.D.R.

Antrim—Var. *bettonii*, Cushendun, April 1886 ! S. A. Brenan.

Dublin—Var. *bettonii*, Kingstown, June 1886 ! W. F. de Vismes Kane.

Wexford—Var. *bettonii*, Alderton, near Kilmanock, Miss Glascott, Sept. 1888 ! G. A. Barrett-Hamilton.

Mayo W.—Enniscoe demesne, Crossmolina, Sept. 1885 ! J. G. Milne.

Waterford—Var. *bettonii*, old Dungarvan road, Clonmel, Aug. 1886 ! and Glenabbey, Sept. 1886 ! A. H. Delap.

Hungary—Sub-var. *carpatica*, Kotlina Thal, Kohlbacher and Felkaer Thal in the Carpathians (Hazay, op. cit.).

Lombardy—Var. *bettonii*, near Esino, Monza and Milan (Pini, Moll. Esino, 1876).

Norway—Sub-var. *obscura*. Dovre in Hamer Stift, Ringerige, Laurvik, Kragero, and Lillesand in Christiansand Stift (Esmark, J. of Conch., Oct. 1886, p. 102).

Var. **heynemanni** Bielz, Fauna Siebenb., 1863, p. 32.

Limax arborum var. *tigrina* Weinland, Weichth. Schwab. Alb., 1876, p. 27, pl. 4, f. 1.
Limax arborum var. *maculata* Roebuck, J. of Conch., Oct. 1885, p. 375.
Limax arborum f. *submaculata* T. D. A. Cockerell, Nautilus, May 1890, p. 12.

ANIMAL pale, with BODY and SHIELD besprinkled with black.

The var. **heynemanni** s.str. is described by Westerlund as having back and shield maculate with small black spots, large rugæ, and a distinct keel.

The sub-var. **tigrina** has two rows of distinct black spots on each side of the body, the mid-dorsal line paler than the body colour, and a spotted shield in which the spots are arranged in five or six longitudinal rows.

The sub-var. **maculata** has the black spots smaller and more numerous; shield with slender lateral bands, which also tend to break up into spots.

The sub-var. **submaculata** has the spots paler, more nebulous and coalescent.

Devon S.—Sub-var. *maculata*, Culverhole Point, Aug. 1892, L. E. Adams.

Pembroke—Sub-var. *maculata*, Pembroke, June 1885 ! Mrs. Trayler.

Clyde Isles—Sub-var. *maculata*, Rothesay, May 1887 ! T. Scott.

Antrim—Sub-var. *maculata*, Cushendun, May 1886 ! S. A. Brenan.

Mayo W.—Sub-var. *maculata*, Enniscoe demesne, Sept. 1885 ! J. G. Milne.

Tipperary S.—Sub-var. *maculata*, near Clonmel, April 1888 ! A. H. Delap.

Waterford—Sub-vars. *maculata* and *submaculata*, near Clonmel, A. H. Delap.

Cork S.—Sub-var. *maculata*, Berehaven, May 1893, R. F. Scharff.

Kerry—Sub-var. *maculata*, immense specimens about Killarney, Sept. 1898 (Stubbs & Adams, Irish Nat., Nov. 1898).

Wurtemburg—Sub-var. *tigrina* (Weinland, op. cit.).

Switzerland—Sub-var. *tigrina*, Berne and Valais (Bœttger, Nachtbl., 1885).

Transylvania—Var. *heynemanni* (Westerlund, Fauna Europæ, 1876).

Greece—Sub-var. *tigrina*, Bugasi-Thal, Thessaly (Bœttger, J.D.M.G., 1885).

Var. **zebrina** Taylor.

BODY grey, inner and main bands distinct, outer band represented by a series of oblique transverse markings, which join the main-band; SHIELD with lateral bands and dusky median area. Formula 321 123.

This distinct variety is, according to Simroth, not very uncommon, and he records it as var. *tigrina* from the Algarve, Portugal; from Transylvania; from Neustadt in the Bohemian Erzegebirge; and from Grimma in Saxony.

Var. **rupicola** Less. & Poll., Monog. Limac. Ital., 1882, p. 16.

Lehmannia marginata ζ *rupicola* Less. & Poll., op. cit.
Lehmannia marginata δ *alpestris* Less. & Poll., op. cit.
Limax marginatus var. *dianæ* Kimackowicz, Beit. Moll. Siebenb., 1884, p. 120.
Limax marginatus var. *niger* Scharff, Irish Nat., 1889, p. 260.

This variety, though occasionally showing faint tracings of the characteristic markings, is in its extreme development entirely black or deep brown in colour, and small in size, with a long and well developed keel. In this state it is also the var. **dianæ** of Kimackowicz and the var. **nigra** of Scharff. Formula (321 123).

When immature the animal is brownish with a pair of obscure bands on the back and shield, which gradually become clouded over and lost as the animal increases in age. The sub-var. **alpestris** of Less. & Poll. indicates one of the stages of this adolescent colouring, as it retains the paler dorsal line, and the lyre-bands on the shield are faintly discernible.

Shetlands—Sub-var. *alpestris*, Unst ! Fetlar ! and Mainland, 1886 ! R. W. J. Smart.

Down—Var. *rupicola*, Newcastle, Oct. 1884 ! H. W. Lett.

Kerry—Var. *rupicola*, on summit of Reek, alt. 2,400 feet, A. H. Delap. Sub-var. *nigra*, Macgillicuddy Reeks, altitude of 2,500 to 3,100 feet (Scharff & Carpenter, Irish Nat., vol. viii., p. 213). Cahir Mountains, Sept. 1898, R. F. Scharff.

Saxony—Var. *dianæ*, heights of the Erzegeberge (Simroth, Nacktschn., 1885).

Austro-Hungary—Var. *dianæ*, Negoispitze Mountain (Simroth, op. cit.).

Piedmont—Sub-var. *alpestris*, Piedmontese Alps (Less. & Poll., op. cit.). Var. *rupicola*, Col d'Ollen, near Gressoney, alt. 8,250 feet (Less. & Poll., op. cit.). Var. *dianæ*, Val di Lanza (Simroth, op. cit.).

Portugal—Var. *dianæ*, Monchique, H. Simroth.

Transylvania—Var. *dianæ*, Heynemann, J.D.M.G., June 1885, p. 260).

Geographical Distribution.—*Limax arborum* is an ancient species, and therefore has a very wide distribution, and is found from the extreme north of Lapland and Iceland to Orotava in Teneriffe; and according to Scharff, has probably been extending its area of habitation since early tertiary times, but its range is probably very imperfectly known, as it is so frequently confused with *L. maximus* and other species.

It has been reported from the British Isles, Germany, Belgium, Holland, France, Spain, Portugal, Switzerland, Austro-Hungary, Italy, Greece, Denmark, Norway, Sweden, and Russia.

In the British Isles *L. arborum* is in all likelihood universally dispersed and the gaps at present shown in its range will probably be filled up as the species becomes better known.

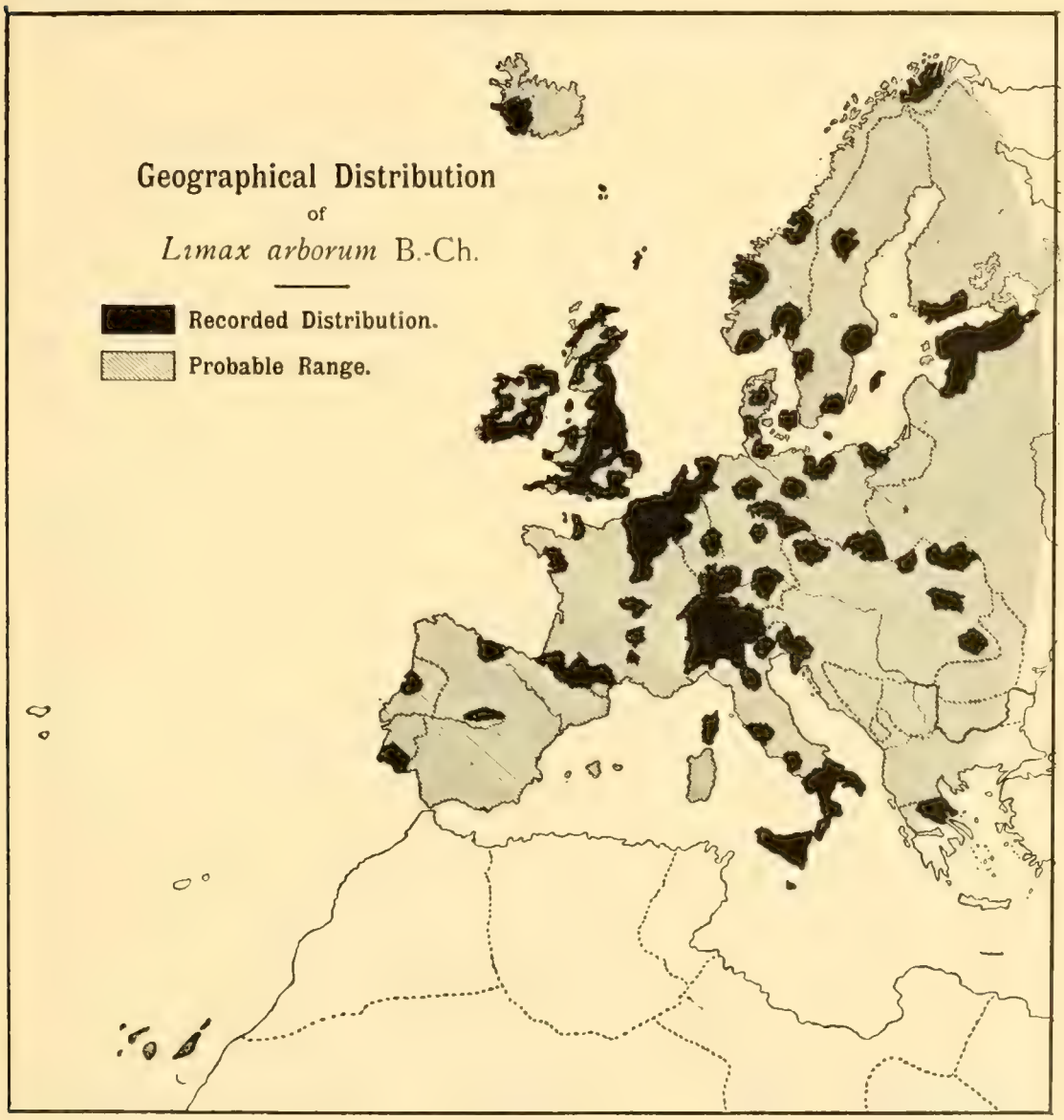


FIG. 113.

ENGLAND AND WALES.

Channel Isles—Guernsey, Jersey, and Sark (Ansted's Channel Isles, 1862).

PENINSULA.

Cornwall W.—Common on trees in the Trevaylor Valley and other similar places (E. D. Marquand, Moll. Cornwall, 1884, p. 4). Phillack, Oct. 1884! Miss Hockin. Trevidock road, St. Colomb, May 1885! W. Vinson. Penzance, E. D. Marquand. Var. *maculata*, Scilly Islands, Aug. 1890! Rev. E. D. Roberts.

Cornwall E.—Mrs. Whitford's garden bank, St. Columb, May 1885! W. Vinson.

Devon N.—Lynton, 1898 (F. J. Partridge, J. of Mal., 1898, p. 19).

Somerset S.—Porlock, Aug. 1892 ! L. E. Adams.

Somerset N.—On trees and rocks in Goblin, Cleeve and Brockley coombes, and in some of the glens running up into the Mendip hills, near Wells (Norman, Moll. Somerset, 1860). Bratton St. Maur (E. W. Swanton, Nat. Journ., May 1895).

CHANNEL.

Dorset—Glanville's Wootton, abundant (Dale, Hist. Glanville's Wootton, 1878, p. 334). Weymouth (Damon, Geol. Dorset, 1884, p. 234). Near the carpenter's yard, East Lulworth (Kendall), and in Clenston wood (Mansel-Pleydell, Moll. Dorset, 1898, p. 4). Sub-var. *nemorosa*, Chideock, Bridport, Aug. 1885 ! A. Belt.

Isle of Wight—Thorley, Lee Copse and Ham Copse, near Yarmouth, July 1879 ! C. Ashford. Sandown, R. Gibbs (Forbes & Hanley, Brit. Moll., 1853, p. 289). Steephill, A. J. Hambrough ; Bembridge, A. G. More ; and Ryde, W. Thompson, 1841 (Venables' Guide to Isle of Wight, 1860, p. 462).

Hants S.—Common on beech trunks, Winchester, 1883, B. Tomlin. Hambledon (L. E. Adams, Sci. Gossip, March 1901). Selborne, June 1889 ! W. Jeffery. Type and var. *maculata*, garden, Christchurch, April 1884 ! Vinney Ridge, June 1887 ! Mudeford ! Bolderwood, Aug. 1887 ! C. Ashford. Vars. *nemorosa* and *bettonii*, Holmsley and Wootton, C. Ashford, and Hambledon, L. E. Adams (Adams & Woodward, Sci. Goss., Mar. 1901).

Hants N.—Preston Candover, Oct. 1881 ! H. P. Fitzgerald.

Sussex W.—Common in beech plantation, Downs, Ratham, June 1884 ! Common among beeches, back of Goodwood race stand (W. Jeffery, J. of C., Apl. 1882).

Sussex E.—Lewes, Mr. Morris, 1883 (B. M. Oakeshott, 1886).

THAMES.

Kent E.—Beech wood, Throwley, Sept. 1877, Miss Fairbrass. Ewell wood, Dover, Sept. 1891, L. E. Adams.

Kent W.—Chislehurst and Sevenoaks, Aug. 1887, S. C. Cockerell. Oak copse, Erith (Leslie, Q.J.C., 1874, p. 34).

Surrey—Wray Park, Reigate, G. S. & E. Saunders, 1861. Warlingham, 1883, T. D. A. Cockerell. Bramley Hill, Croydon, K. McKean, Croydon List, 1883. Var. *nemorosa*, Reigate Hill, April 1889 ! H. W. Kew.

Essex S.—Weald Hall Park, Brentwood, Feb. 1884 ! R. M. Christy. Chingford, and Loughton, Epping Forest, Aug. 1890, H. W. Kew.

Herts.—Near Watford, Oct. 1883 ! J. Hopkinson.

Oxford—Abundant in the beech woods on the Chiltern Hills, near Watlington (A. M. Norman, Zool., 1853, p. 4126). Plentiful at Oxford, Swincomb, Wychwood, and Charlbury ; fairly common at Chipping Norton ; uncommon at Banbury (Collinge, Conch., 1891, p. 12). Sub-var. *nemorosa*, specimens from Dr. Norman, labelled "Oxford," in British Museum (T. D. A. Cockerell, 1891). Sub-var. *lincolata*, Nelthorpe near Banbury (Collinge, Zool., Apl. 1890, p. 145).

ANGLIA.

Suffolk E.—Rare at Mendlesham and Wetheringsett (Mayfield, J. of C., Apl. 1903).

Norfolk W.—Sub-var. *nemorosa*, Lynn, Sept. 1886 ! C. B. Plowright.

Norfolk E.—Catton and Thorpe Toll-Bar (J. B. Bridgman, Norf. and Norw. Trans., 1871). Beech trees, Whitlingham Woods, and on willows at Eaton (Pearce & Mayfield, J. of C., July 1894). Holt, June 1893 ! T. Petch. Vars. *decipiens* and *pallens*, specimens from Norwich in British Museum (T. D. A. Cockerell, 1891).

SEVERN.

Northampton—Rockingham Park, May 1896 ! and Dane's Camp, Northampton, Nov. 1896, L. E. Adams. Fletton (A. W. Nicholls, J. of C., Apl. 1884).

Monmouth—Chepstow and Tintern Abbey, Aug. 1892, L. E. Adams.

Gloucester E.—Cooper's Hill, Cheltenham, Apl. 1866 ! Stroud, Mch. 1884 ! E. J. Elliott. Var. *pallens*, Cheltenham, specimens in Brit. Mus. (T. D. A. Cockerell).

Gloucester W.—Plentiful on beeches near Stroud, Oct. 1883 ! E. J. Elliott.

Hereford—Bishopswood Vicarage, Ross, June 1885 ! R. W. J. Smart. Doward Hill (Boycott, Sc. Goss., April 1892, p. 78). Backbury Hill, Boycott & Bowell, 1899.

Worcester—King's Norton, Oct. 1884 ! J. Madison. Yardley ! Greet ! and Sarehole ! W. Nelson. Droitwich, autumn, 1882, E. B. Fairbrass.

Warwick—Bentley Heath, near Knowle, Jan. 1873 ! W. Nelson. Ingon Grange gardens, near Stratford-on-Avon, Sept. 1884 ! R. J. Attye. Timber yard, Sutton Coldfield, H. Overton, 1903.

Stafford—Walls, Stafford Castle, Oct. 1885 ! Cannock Chase, Milford, June 1886 ! and Coppenhall, L. E. Adams. Yardley and Harborne (Tye, Q.J.C., May 1875, p. 68). Rosehill, Cheadle, June 1888 ! Alton Castle, Feb. 1890 ! and Meaford, near Stone, J. R. B. Masefield, 1902. Leek and Kingsley, Sept. 1885, T. D. A. Cockerell.

SOUTH WALES.

Glamorgan—Cardiff (Wotton, Brit. Assoc. Hdbk., 1891). Llandaff (id., J. of C., Apl. 1886). Vars. *nemorosa* and *maculata*, Aberkenfig, Aug. 1890 ! G. K. Gude.

Pembroke—Pembroke, June 1885 ! Mrs. Trayler. St. David's, July 1891, J. B. Morgan. Not uncommon on mossy rocks on North Cliff, Tenby, on ash trees, Cemetery lane, and on beech trees, Penally (A. G. Stubbs, J. of Conch., July 1900, p. 322). Sub-var. *maculata*, Pembroke, June 1885 ! Mrs. Trayler.

NORTH WALES.

Montgomery—Under stones, Guilsfield, Nov. 1888 ! Forden, June 1886 ! under log, Welshpool, June 1888 ! and Gungrog dingle (J. Bickerton Morgan).

Merioneth—Barmouth, Aug. 1884 ! John Hopkinson. Palé, Corwen, May 1887 ! T. Ruddy. Sub-var. *nemorosa*, Bont ddu, Sept. 1886 ! F. G. Fenn.

Carnarvon—Under waterfall, Aber, Aug. 1883 ! John Hopkinson. Trefriw, July 1883 ! W.D.R. Criccieth, May 1887 ! W. Cash. Fine in churchyard, Dwygyfylchi, R. D. Darbishire. Llanberis (T. D. A. Cockerell, Nat. World, March 1887).

Denbigh—Beechwoods near Llanrwst, July 1883 ! W.D.R. Great Orme's Head, Jan. 1888, L. E. Adams. Oak copse, Bont-ddu (F. G. Fenn, J. of C., July 1887).

Anglesey—Var. *bettonii*, Llanfaes, Sept. 1886 ! J. G. Milne.

TRENT.

Lincoln S.—Careby wood, Grantham, June 1903 ! E. A. Woodruffe-Peacock.

Lincoln N.—Near Louth, Oct. 1885 ! R. W. Goulding. Ulceby-with-Fordington, Oct. 1889 ! J. B. Davy. Well Vale, Alford, Sept. 1889 ! Maltby wood, and wall along Lincoln road, near Louth, Apl. 1886 ! W.D.R. Var. *bettonii*, Jenny wood, Louth (H. W. Kew, Nat., March 1886).

Notts.—Southwell, Sept. 1892 ! C. Oldham. Sparingly, Thrumpton, and abundant on trees, etc., at Highfield House; common on the Tottle Brook bridge, at the base of the Beeston Hill (E. J. Lowe, Conch. Notts., 1853). Cresswell crags and Tollerton, April 1884 ! and Nottingham Castle rock, C. T. Musson. Wilford, etc. (Dodd & Musson, Nott. Moll., 1881, p. 5). Tuxford, Pleasley, Mansfield, Southwell, etc., C. T. Musson. Haughton (W. A. Gain, Brit. Nat., Nov. 1893, p. 226). Welbeck, etc. (Lowe & Musson, Mid. Nat., Aug. 1879, p. 199).

Derby—Pleasley Vale, April 1884 ! C. T. Musson. Winster, alt. 650 feet, June 1885 ! H. Milnes. Chee Dale, near Buxton, Sept. 1885 ! J. G. Milne. Type and var. *nemorosa*, between Hathersage and Bakewell, 1889 ! and var. *nemorosa*, Ashbourne, Aug. 1889 ! L. E. Adams. Var. *subrufa*, Chapel-en-le-Frith, June 1897 ! C. Oldham.

MERSEY.

Cheshire—Mere Park, Knutsford, Oct. 1885 ! J. G. Milne. Numerous at Upton, 1852; occasionally at "sugar" on trees, at Rainhill (Higgins, Liverpool List, 1891). Congleton, Sept. 1885, T. D. A. Cockerell. Ashley, J. G. Milne, Nat., Aug. 1887. Var. *bettonii*, Capesthorne, Aug. 1894 ! C. Oldham.

Lancashire S.—Botanical Gardens, Manchester ! J. R. Hardy. Northenden lane, Didsbury, 1860 (J. Hardy, Manchester List, 1865, p. 34). Knowsley, near Liverpool, 1893 (W. E. Collinge, J. of Mal., June 1893, p. 148).

Lancashire Mid—Alder trees near the river Hodder, at Chaigeley Manor, near Clitheroe, and at Corby Castle, near Lancaster, E. J. Lowe.

HUMBER.

York S.E.—Sledmere, Aug. 1891 ! F.W. Fierke. Howsham Woods, Sept. 1889 ! W.D.R. Kirkham Abbey ! (A. H. Taylor, Nat., Nov. 1889).

York N.E.—Skelton Beck Valley, Saltburn, May 1887 ! and Kirkleatham, Sept. 1886 ! W.D.R. Hawnby, near Thirsk, 900 feet alt., J. G. Baker; and near Feliskirk, G. R. Baker (J. H. Davies, Nat., 1855, p. 134). Rye Bridge, Rievaulx, July 1884 ! Pickering Castle Hill, July 1886 ! and Duncombe Park, Helmsley, July 1885 ! W.D.R. Scarborough, W. Bean (Theakston's Guide to Scarborough, 1871, p. 176). Hayburn Wyke, Aug. 1894 ! F. W. Fierke. Kilton Castle, April 1889 ! B. Hudson. Ingleby Greenhow, Sept. 1890 ! J. Hawell. Coxwold, Sept. 1892 ! W.D.R. Middlesbrough, Baker Hudson, Sci. Goss., Nov. 1886, p. 259.

York S.W.—Roche Abbey Woods, April 1884 ! W.D.R. Common, Cubley Wood, May 1890, L. E. Adams. Haw Park and Ferry Bridge (J. Wilcock, Twelfth Report Wakefield Nat. Soc., 1883, p. 28). Saltaire, Nov. 1886 ! H. T. Soppitt. Not common, Calverley Wood ; Idle ; Cottingley and Seven Arches, near Bingley (Soppitt & Carter, Nat., 1888, p. 97). Field, near Wellhead, Halifax, J. E. Crowther. Endcliffe Wood, Sheffield, May 1893 ! C. Oldham. Sub-var. *nemorosa*, Rose Hill, Penistone, July 1889 ! L. E. Adams.

York Mid W.—Pateley Bridge, May 1882 ! W. Storey. Glasshouses ! roadsides, near Gouthwaite Hall ! and Ripley ! May 1886, W.D.R. Gordale Scar, July 1877 ! Ingleton ! Bolton Abbey, 1874 ! and Threshfield, 1882 ! W. Nelson. Limestone scars on Buckden Pike, alt. 1,800 feet, May 1886 ! W.D.R. Airton, Oct. 1883; Denton Park, 1890, H. T. Soppitt. Mason Plain, Grassington, Sept. 1900, F. Rhodes. Shireoaks Wood, Tadcaster, F. G. Binnie, 1880. Harewood Park walls ! Alwoodley, Oct. 1882 ! Scarcroft ! and Cock Beck Bridge, Garforth, 1870 ! W. Nelson. Varieties *subrufa* and *nemorosa*, Mickley, abundant, Aug. 1889 ! W.D.R.

York N.W.—Bowes Castle Keep! Ivelet Bridge! Thwaite! Gunnerside Gill! July 1884, and near Wood House, Arkengarthdale, Aug. 1885! W.D.R. East Witton, Sept. 1877! W. Nelson. Bolton Castle, Aug. 1882! Bank Wood, Semerdale, July 1884! and Whitfield Gill Woods, June 1884! W.D.R. Staveley Church roof, Feb. 1883! E. P. Knubley. Sedbergh, 1894! W.D.R.

TYNE.

Durham—Woods at Wolsingham and Shotley Bridge, W. Backhouse (Alder's Northumb. and Durham Cat., 1848). Cauldron Snout, July 1884! W.D.R. Middleton-in-Teesdale, June 1884! Baker Hudson. Barnard Castle (E. J. Lowe, 1885).

Northumberland—Stocksfield-on-Tyne, May 1885! H. E. Craven. West Woodburn, Oct. 1887, R. Howse.

Cheviotland—Howick Woods, R. Embleton (Alder's Northumb. and Durham Cat., 1848, p. 125). Dean above Akeld, May 1852 (G. Johnston, Proc. Berwick Nat. Club, 1852, p. 89). Abundant on old wall, Akeld near Wooler, Sept. 1887! R. Howse.

LAKES.

Westmorland and Lake Lancashire—Coniston, Oct. 1886! W.D.R. Coniston Old Man, alt. 2,660 feet, July 1887, and Ambleside, April 1890, S. C. Cockerell.

Cumberland—Carlisle, June 1886! J. Madison. Scales, Sept. 1890! Brundholme Wood, Keswick, Oct. 1890! J. Hawell.

Isle of Man—Swarmed on the walls along upper road from Port Erin to Port St. Mary, June 1881! L. E. Adams. Near Nunnery, Douglas, July 1880! W. Nelson. Peel, Aug. 1894, R. Cairns.

SCOTLAND. *WEST LOWLANDS.*

Ayr—As common as in Ireland (Thompson, Report Brit. Assoc., 1843, p. 254).

Renfrew—Near old castle, Inverkip road, Greenock, Aug. 1886! W.D.R. Cloch and other places (T. Scott, Greenock List, 1886).

EAST LOWLANDS.

Peebles—Roadside walls, east of Walkerburn, Aug. 1886! W.D.R. West Linton, Sept. 1893, W. Turner. Cademuir, near Peebles, July 1890! W. Evans.

Selkirk—Var. *nemorosa*, near Selkirk, Oct. 1890! W. Evans.

Roxburgh—Walls of Melrose Abbey, Aug. 1886! W.D.R.

Berwick—Fans, near Earlston, Oct. 1883! R. Renton. Redpath, near Earlston, Aug. 1886! W.D.R. Eyemouth, Sept. 1895, W. Evans. Type and sub-var. *nemorosa*, Coldingham, Sept. 1890! W. Evans.

Haddington—Bass Rock, J. McMurtrie, Dec. 1888. Tyninghame, Sept. 1894, Yester, Sept. 1896, Aberlady, Sept. 1889! and var. *alpestris*, North Berwick Law, Sept. 1890, W. Evans.

Edinburgh—Wallyford, Aug. 1886! W.D.R. Salisbury Craigs, Sept. 1888, T. Scott. Penicuik Woods, Oct. 1896; Pentland Hills, April 1896; Dreghorn Woods, Sept. 1889! Colinton! Caroline Park, near Granton, Nov. 1890! Balerno and Bavelaw, with sub-var. *nemorosa*, April 1890! W. Evans.

Linlithgow—Fairly common on rocks and under the bark of trees, about Bo'ness, Linlithgow, etc., R. Godfrey. Caribber Glen, March 1892, W. Evans.

EAST HIGHLANDS.

Fife and Kinross—Aberdour, Nov. 1886! A. Somerville. Falkland, Aug. 1895; St. Andrews, July 1890! Burntisland and Charlestown, Feb. 1896, W. Evans. Var. *nemorosa*, St. Andrew's Bay, May 1889! E. E. Prince.

Stirling—Ben Lomond, Aug. 1892, W. M. Webb. Polmont, Aug. 1890! W. Evans. Type and sub-var. *nemorosa*, Cambusbarron, July 1894! A. McLellan.

Perth S. and Clackmannan—Bridge of Allan, Feb. 1898; Aberfoyle, April 1892; Balquhidder, Sept. 1902; and Callander, April 1892! W. Evans.

Perth Mid—On Ben Lawers, alt. 3,000 feet (F. Buchanan White, Scottish Nat., 1873, p. 164). Perth, Sept. 1884, Howard Bendall. Glen Tilt, May 1885! H. Coates. Loch Tay side, April 1887! J. E. Somerville. Bridge of Loch Tay, E. J. Lowe.

Perth N.—Var. *alpestris* s.str., Blairgowrie, July 1890! W. Evans.

Forfar—Montrose, July 1884! W. Duncan. Den of Airlie, Sept. 1886! C. B. Plowright.

Kincardine—Sub-var. *nemorosa*, Banchory! W. Evans.

Aberdeen S.—Common, Old Aberdeen, May 1842 (Macgillivray, Moll. Aberd., 1843). Den of Leggart (J. Taylor, Zool., 1853, p. 3878). Drum Woods, Oct. 1886! and var. *subrufa* and type, Mony Musk Woods, Sept. 1886! C. B. Plowright.

Banff—Ballindalloch, May 1891! W. Evans. Var. *alpestris* s.str., Glenfiddack, July 1891! G. Gordon.

Elgin—Birnie, 1853 (G. Gordon, Zool., 1854, p. 4453). Elgin, McAndrew Coll., Cambridge (A. H. Cooke, J. of C., Oct. 1882). Cromdale, Aug. 1891! W. Evans. Sub-var. *nemorosa*, Castle Roy by Nethy Bridge, Aug. 1891! W. Evans.

Easterness—Kincraig by Kingussie, Aug. 1889! W. Evans.

WEST HIGHLANDS.

Main Argyle—Dunoon, Aug. 1886! W.D.R. Oban, W. H. Heathcote.

Clyde Islands—Rothesay, Bute, May 1887! T. Scott. Arran, April 1887! J. E. Somerville.

Cantire—Old castle, West Loch, Tarbert (T. Scott, J. of Conch., July 1886).

Ebudes S.—Mr. Thompson found it on Islay (Forbes & Hanley, Brit. Moll., 1853).

Ebudes Mid—Iona, Sept. 1889! J. E. Somerville. Allt-na-Searmoin Glen, Salen, Mull, June 1900! W.D.R.

Ebudes N.—Eigg, Aug. 1888! J. McMurtrie.

NORTH HIGHLANDS.

Ross W.—Ullapool, Aug. 1886! A. Somerville. Loch Carron, Nov. 1886! J. E. Somerville.

Sutherland E.—Blue Rock and Golspie Burn, Brora, June 1884! W. Baillie.

Sutherland W.—Stoer, Oct. 1886! J. E. Somerville.

Caithness—Dunbeath river, May 1884! W. Baillie.

NORTH ISLES.

Shetlands—Unst, Fetlar, and Mainland, Aug. 1886! R. W. J. Smart. Outskerries (Jeffreys, Brit. Conch., i., p. 136).

IRELAND.

ULSTER.

Derry—Coleraine, moderately common, Nov. 1883! L. E. Adams. Ballynagard, June 1892, D. C. Campbell (R. F. Scharff).

Antrim—Large at Giant's Causeway, R. D. Darbishire. Whitehall, Broughshane, June 1886! S. A. Brenan. Rathlin Island, May 1897, L. E. Adams. Armoy, R. Welch. Murlough Wood, Ballycastle (R. Standen, Irish Nat., Jan. 1897).

Down—Cultra, Dec. 1891, R. F. Scharff. Crawfordsburn, May 1902! R. Welch.

Tyrone—Strabane, A. H. Delap. Type and sub-var. *nemorosa* Kaneswood, near Aughnacloy, July 1886! W. F. de Vismes Kane.

Donegal—About Strabane, A. H. Delap.

LEINSTER.

Louth—Type and sub-var. *nemorosa*, Piperstown, Nov. 1889! Miss Sidney Smith.

Meath—New Grange, June 1892, R. F. Scharff.

Dublin—Howth, April 1887! Killakee, Sept. 1890; and Rush, Aug. 1889, R. F. Scharff.

Kildare—Kildare, 1884, J. E. Palmer.

Wicklow—Powerscourt, May 1886! W. F. de Vismes Kane. Woodenbridge, R. F. Scharff, Irish Nat., 1893, p. 149. Common on beeches, Delgany; and under stones, Brayhead, July 1891, R. F. Scharff.

Wexford—Kilmanock, New Ross, Aug. 1888! G. Barrett-Hamilton.

Kilkenny—Kilkenny, March 1903, P. H. Grierson.

Queen's Co.—La Bergerie (B. J. Clarke, Ann. and Mag. N.H., 1840, p. 204). Spire Hill Wood and Emo Park (B. J. Clarke, op. cit., 1843, p. 337).

Westmeath—On beech trees, Knockdrin demesne, April 1892, R. F. Scharff.

CONNAUGHT.

Sligo—Common in woods near Ballina (Amy Warren, Zool., Jan. 1879, p. 26). Plentiful, Rockwood, Lough Gill, Oct. 1886! W. F. de Vismes Kane.

Mayo W.—Enniscoe demesne, Crossmolina, Sept. 1885! W. F. de Vismes Kane. Slievemore and Dugort, Achill Island, Aug. 1886! J. G. Milne. Moyview, Ballina, July 1891! Amy Warren. Var. *nemorosa*, Newport (J. G. Milne, J. of C., Oct. 1891).

Galway W.—Roundstone and Kylemore, Mch. 1891, R. F. Scharff. Aran Islands, Oct. 1890 (R. F. Scharff, Irish List, 1892, p. 8). Gentian Hill; Ballyvaughan; and woods by Lough Corrib, July 1895 (R. Standen, Irish Nat., Sept. 1895, p. 267).

Galway E.—Common on beech and other trees in moist woods, Monivea (B. J. Clarke, Ann. and Mag. N.H., 1840, p. 204). Tuam Palace demesne (B. J. Clarke, op. cit., 1843, p. 337). Common at Clonbrock, June 1896 (R. F. Scharff, Irish Nat., Sept. 1896, p. 223).

MUNSTER.

Clare!—T. Rogers' collection, Sept. 1885.

Tipperary S.—Type and var. *maculata*, near Clonmel, April 1888, A. H. Delap.

Waterford—Common (J. Fayle, Nat., Aug. 1858, p. 190). Near Waterford, Sept. 1883! J. H. Salter. Sub-var. *rupicola*, near Clonmel, A. H. Delap.

Cork N.—Common at Blarney, Sept. 1898, L. E. Adams. Sub-var. *maculata*, Queenstown Junction, Cork, June 1893, R. F. Scharff.

Cork S.—Common, Bantry, Sept. 1898, L. E. Adams. Commonest slug about Glengariff, June 1893, R. F. Scharff.

Kerry—On bare stones and rocks, Connor Cliffs, Dingle, alt. 1,500 feet, Prof. Forbes. Valentia Island, July 1886! A. H. Delap. Common, Kenmare and Killarney, Sept. 1898, L. E. Adams. Skellig Rocks (R. F. Scharff, Irish List, 1892, p. 8). Var. *glauca*, Killarney, Sept. 1884, Howard Bendall.

GERMANY.

Has been recorded from Alsace, Altenburg, Baden, Bavaria, Brandenburg, Brunswick, Franconia, Hanover, Holstein, Nassau, Pomerania, Pyrmont, Rhineland, Saxony, Schleswig, Silesia, Thuringia, and Wurtemburg.

NETHERLANDS.

Belgium—(Heynemann, Jahrb. Deutsch. Mal. Ges., 1885, p. 247).
Holland—(Heynemann, op. cit.).

FRANCE.

Found more especially in the mountain districts, and in the extreme north-east section of the country, and has been reported from Aisne, Ariége, Aude, Basses Pyrénées, Champagne Meridionale, Haute Garonne, Hautes Pyrénées, Ille et Vilaine, Lozère, Manche, Morbihan, Nièvre, Nord, Oise, Pas-de-Calais, Puy-de-Dôme, Seine Inférieure, Seine et Marne, Somme, Vienne, and the Isle of Corsica.

SWITZERLAND.

Reported from the cantons of Lucerne, Berne, St. Gall, Grisons, and Valais.

ITALY.

Found in Lombardy, Piedmont, Venetia, Campania, Rome, Modena, and Sicily. Also recorded as *Amalia marginata* v. *mongianensis* from Mongiana, Calabria.

AUSTRO-HUNGARY.

Found in Bohemia, Carniola, Galicia, Hungary, Styria, Transylvania, and Tyrol.

SPAIN AND PORTUGAL.

Spain—Hoy de Barcena, and near Santander, May 1860, E. J. Lowe. A small form found on the Sierra de Guadarrama, by von Heyden.
Portugal—Oporto and Monchique, H. Simroth.

GREECE.

Thessaly—Bugasi-Thal in the Ossagebirge (Bœttger, op. cit.).

SCANDINAVIA.

Norway—Common throughout, and has been found as far north as Kistrand and Porsangerfjord in Finmark, 70° 25′ north lat. It reaches its highest elevation of 2,800 feet at Tonset in Osterdalen.

Sweden—Well distributed in Sweden, and has been found as far north as Härjedalen in Jämtland, 62° 30′ north lat. It is also found on Gotland and Bornholm.

Denmark—Not common in the Viborg district of Jutland, but the commonest species in the beech woods of Zealand.

It is also recorded from the **Faroes** and the south coast of **Iceland.**

RUSSIA.

Only at present known from Esthland, Livonia, St. Petersburg, and Finland, its most northern locality being at Valamo in Finland, 61° 25′ north lat.

ATLANTIC ISLES.

Canaries—Orotava, Teneriffe, W. Moss (Collinge & Partridge, J. of Mal., 1899).

FIG. 111.—Pollard Hornbeams at Loughton, Epping Forest, a haunt of *Limax arborum* (photo. by Mr. J. G. Randall).

Distribution of *Limax arborum* B.Ch.

In the Counties and Vice-Counties of the British Isles.

ENGLAND AND WALES.

Channel Isles

PENINSULA
1 Cornwall W.
2 Cornwall E.
3 Devon S.
4 Devon N.
5 Somerset S.
6 Somerset N.

CHANNEL
7 Wilts N.
8 Wilts S.
9 Dorset
10 Isle of Wight
11 Hants S.
12 Hants N.
13 Sussex W.
14 Sussex E.

THAMES
15 Kent E.
16 Kent W.
17 Surrey
18 Essex S.
19 Essex N.
20 Herts.
21 Middlesex
22 Berks.
23 Oxford
24 Bucks.

ANGLIA
25 Suffolk E.
26 Suffolk W.
27 Norfolk E.
28 Norfolk W.
29 Cambridge
30 Bedford
31 Hunts.
32 Northampton

SEVERN
33 Gloucester E.
34 Gloucester W
35 Monmouth
36 Hereford
37 Worcester
38 Warwick
39 Stafford
40 Salop

SOUTH WALES
41 Glamorgan
42 Brecon
43 Radnor
44 Carmarthen
45 Pembroke
46 Cardigan

NORTH WALES
47 Montgomery
48 Merioneth
49 Carnarvon
50 Denbigh
51 Flint
52 Anglesey

TRENT
53 Lincoln S.
54 Lincoln N.
55 Leic. & Rutld
56 Notts.
57 Derby

MERSEY
58 Cheshire
59 Lancashire S
60 Lancashire Mid

HUMBER
61 S.E. York
62 N.E. York
63 S.W. York
64 Mid W. York
65 N.W. York

TYNE
66 Durham
67 Northumb. S.
68 Cheviotland

LAKES
69 Westmorland and L. Lancs.
70 Cumberland
71 Isle of Man

SCOTLAND.

W. LOWLANDS
72 Dumfries
73 Kirkcudbright
74 Wigtown
75 Ayr
76 Renfrew
77 Lanark

E. LOWLANDS
78 Peebles
79 Selkirk
80 Roxburgh
81 Berwick
82 Haddington
83 Edinburgh
84 Linlithgow

E. HIGHLANDS
85 Fife & Kinross
86 Stirling
87 Perth S. & Clkn
88 Mid Perth
89 Perth N.
90 Forfar
91 Kincardine
92 Aberdeen S.

E. HIGHLANDS
93 Aberdeen N.
94 Banff
95 Elgin
96 Easterness

W. HIGHLANDS
97 Westerness
98 Main Argyle
99 Dumbarton
100 Clyde Isles
101 Cantire
102 Ebudes S.
103 Ebudes Mid
104 Ebudes N

N. HIGHLANDS
105 Ross W.
106 Ross E.
107 Sutherland E.
108 Sutherland W.
109 Caithness

NORTH ISLES
110 Hebrides
111 Orkneys
112 Shetlands

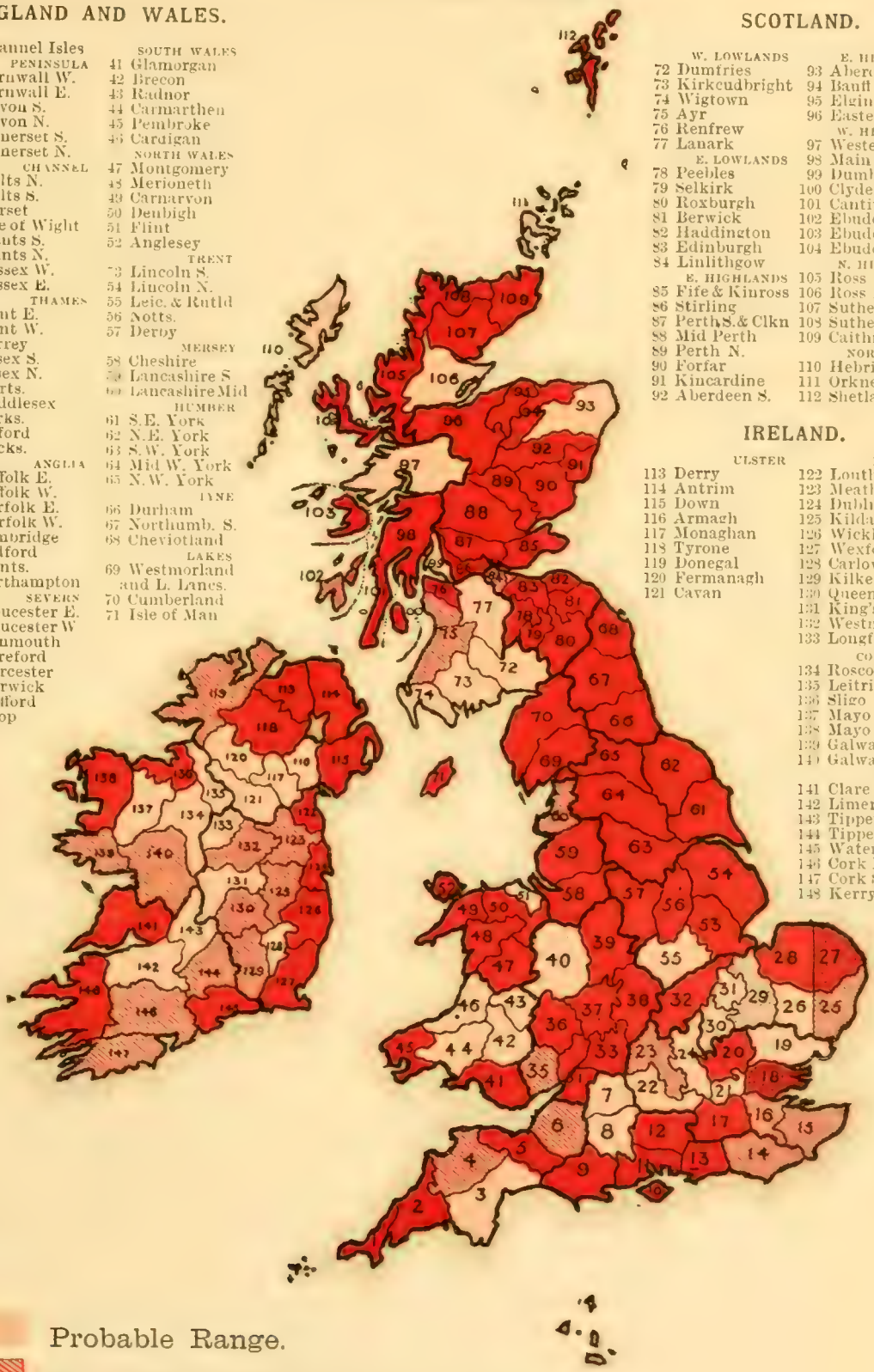
IRELAND.

ULSTER
113 Derry
114 Antrim
115 Down
116 Armagh
117 Monaghan
118 Tyrone
119 Donegal
120 Fermanagh
121 Cavan

LEINSTER
122 Louth
123 Meath
124 Dublin
125 Kildare
126 Wicklow
127 Wexford
128 Carlow
129 Kilkenny
130 Queen's Co.
131 King's Co.
132 Westmeath
133 Longford

CONNAUGHT
134 Roscommon
135 Leitrim
136 Sligo
137 Mayo E.
138 Mayo W.
139 Galway W.
140 Galway E.

MUNSTER
141 Clare
142 Limerick
143 Tipperary N.
144 Tipperary S
145 Waterford
146 Cork N.
147 Cork S.
148 Kerry



Probable Range.

Recorded Distribution.

Distribution verified by the Authors.

Fossil Distribution.

Genus *AGRIOLIMAX* Mörch.

The genus *Agriolimax* or field slugs (*Ager*, a field; and *Limax*) was established in 1865 by Dr. O. A. L. Mörch, of Copenhagen, the eminent Danish malacologist, with whom it is a pleasure to associate the genus.

The acute discernment manifested by Dr. Mörch in the institution of this genus has been fully justified by the structural peculiarities which further study has demonstrated to exist.

Generic Characteristics. — The Agriolimaces in their typical species have been shown to be quite sharply defined internally and externally from the true Limaces. Not only is the whole scheme of coloration essentially dissimilar in so far as there is a total absence of the longitudinal banding which constitutes so striking a feature in *Limax*, but the arrangement of the gut and the liver or digestive gland is on quite a different plan, as there are but three typical coils or tracts of the intestinal canal, as in the *Helicidæ*, all of which are imbedded within the substance of the right lobe of the liver, which in this group forms the posterior end of the viscera, whereas the left lobe occupies that position in *Limax*; the left lobe in *Agriolimax* is laid obliquely in front of the crop, and is not directed backwards, as in the true Limaces.

Contrary also to what obtains in *Limax*, where the ingestive or stomach tract is the longest, in *Agriolimax* it is the shortest of the series; furthermore, the male organ is free in the present genus, and not looped between the retractors of the upper and lower tentacles, as in *Limax*; the whole arrangement being thus strikingly different in the two groups.

In addition the viscera have also retained a vestige of the previous possession by the animal of a dextrally-coiled external shell, in the strong spiral twist to which the internal organs are subjected, a feature which has become completely lost in *Limax*, as no evidence of a past torsion of the viscera is now perceptible.

Geographical Distribution.—The genus *Agriolimax* has originated within, and is naturally characteristic of the northern hemisphere, its most highly organized species belonging to the western palæarctic region and although it is also found in other and very widely distant places, these occurrences are probably solely due to artificial transportation.

As we have seen in preceding groups, the more primitive or ancestral species still existent at the present day have, by stress of competition with the more advanced forms, been expelled from the more vigorous districts, and are now met with chiefly in the Mediterranean, Caucasian, and other regions still more remote from their probable evolutionary area.

Agriolimax agrestis (L.).

Aliæ parvæ, ut quæ gregatim folia sectantur, et hortos infestant cinerei aut fusci coloris Gesner, de Aquatil. lib. 4, pp. 254 et 256.
Limax cinereus parvus, immaculatus, pratensis Lister, Hist. Anim. Angl., 1678, p. 130, tab. 2, f. 16.
Limax cinereus immaculatus L., Fauna Suec., 1746, p. 366, No. 1279.

1758 *Limax* **agrestis** L., Syst. Nat., ed. x., i., p. 652.
1774 — *reticulatus* Müller, Verm. Hist., ii., p. 8, No. 207.
1819 — *bilobatus* Fér., Hist. Moll., p. 74, pl. 5, f. 11.
1841 — *tunicata* Gould, Invert. Massachusetts, p. 3.
1848 — *pallidus* Schrenk, Land u. Sussw. Livlands.
1855 — (*Eulimax*) *agrestis* Moq.-Tand., ii., p. 22, pl. 2, f. 18-22, and pl. 3, f. 1, 2.
1861 — *veranyanus* Bourg., Spicil. Malac., p. 30, pl. 13, f. 9.
1862 — *heydeni* Heynemann, Mal. Bl., p. 210.
1870 — *norvegicus* Westl., Fauna Moll. Suec., p. 22.
1874 — (*Agriolimax*) *fedtschenkoi* Koch & Heynemann, J.D.M.G., p. 153.
1815 *Limacella obliqua* Brard, Coq. Paris, p. 118, pl. 4, ff. 5, 6, 13, 14, 15.
1868 **Agriolimax** *agrestis* Malm, Skand. Limac., p. 69, pl. 3, f. 8.
1882 — *panormitanus* Less. & Poll., Monog. Limac. Ital., p. 52, pl. 1, f. 5.

Theo. D. A. Cockerell.

HISTORY.—*Agriolimax agrestis* (*agrestis*, inhabiting fields) is one of the commonest and most destructive of our native species, and was noticed and discriminated by some of the earliest writers.

It was first added to the British lists by Martin Lister in 1674, who distinguished it from other kinds by its smaller size and its peculiar milky-white mucus.

It is the most highly organized of the genus, and owing to its marvellous powers of adaptation and its habit of frequenting cultivated land, it has been transported to almost every land where the white man has established himself, thriving under its new surroundings to the prejudice of the aboriginal species.

According to Mr. C. T. Musson, *Limax molestus* Hutton and *L. legrandi* Tate are both referable to our *Agriolimax agrestis*, while Luther considers *L. heydeni* Heynemann as another synonym of the same species. The *Limax weinlandi* of Heynemann has also been regarded as merely another form of this widely-dispersed slug.

With this species Prof. T. D. A. Cockerell, F.Z.S., of Las Cruces, New Mexico, U.S.A., has been associated in recognition of his valuable labours in the elucidation of the variation and affinities of the present and other species.

Diagnosis.—Externally, *A. agrestis* may be distinguished from its congeners by its pale ochreous or whitish body colour, sometimes spotted or blotched with darker pigment, but more especially by its milky-white slime.

Internally, it is sharply separated from all other British slugs by the bulky penis-sheath, and the variously digitate claw-like flagellum at its distal extremity.

Description.—ANIMAL limaciform, with large but flattened tubercles; of a somewhat uniform whitish or pale ochreous ground colour, but sometimes dull lavender or other tint, often mottled, speckled or reticulated with brown or black, and at times totally suffused with black; BODY somewhat compressed and keeled towards the tail; TENTACLES dark coloured; SHIELD more than one-third the total length of the animal, rounded in front and behind, concentric striæ not deep, with the nucleus on the right side and towards the rear; RESPIRATORY ORIFICE with a broad usually unpigmented raised ring, which is cut anteriorly by the anal cleft; SOLE pale and longitudinally tripartite, the side areas sometimes darker, especially towards the tail; SOLE-FRINGE separated as usual from the body by a furrow, containing a row of elongate tubercles, upon which the body tubercles rest unconformably. MUCUS plentiful and viscous, often clear when crawling, but becoming milky-white on irritation, due to innumerable particles of carbonate of lime.

Length usually about 35 mill.

SHELL white, oblong-oval in shape, somewhat convex above and correspondingly concave below, usually rather thin; NUCLEUS distinct and placed towards the left side of the posterior margin of the shell; concentric lines of growth perceptible, margin membranaceous.

Length, 4 mill.; width, 2¼ mill.

FIG. 117.—Internal shell of *Agriolimax agrestis*, × 4. (Markland Grip, Derbyshire, Mr. C. T. Musson).

INTERNALLY, the cerebral ganglia are triangular in shape, spotted with brown, especially at the margins, the commissure grey or darkly spotted; the stomato-gastric or buccal ganglia with longish commissure and dark-brown connectives; the parieto-splanchnic ganglia are fused with the pedal ganglia, and both display short commissures; the vestigial osphradium can be traced as a ridge and channel across to the left of the respiratory chamber; the organ of Semper shows well-developed inferior lobes.

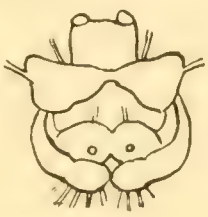


FIG. 118.—Nerve centres of *A. agrestis*, showing otocysts × 8. (Christchurch, in Hants S., Mr. C. Ashford).

The ALIMENTARY CANAL is triodromous, composed of the stomach tract and three intestinal coils; the INGESTIVE TRACT is the shortest, the ŒSOPHAGUS is also short, and the voluminous CROP of a light-brown colour, thin, and scarcely furrowed, having the long and much-indented SALIVARY GLANDS adherent to its sides. The last tract or rectum has, about mid-way, a short cœcum on the right side generally directed backwards, and laid upon the upper surface of the crop. The DIGESTIVE GLAND is of an ochreous colour, the right lobe extending quite to the caudal end of the body, and in common with the whole intestinal mass has been subjected to a noticeable spiral twist in such a way as to indicate that an external shell if present would be a dextrally-coiled one.

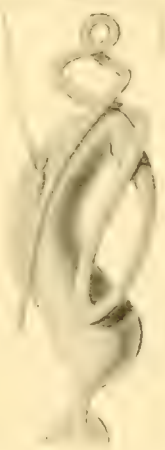


FIG. 119.—Alimentary canal of *A. agrestis*, × 2, with the salivary glands removed and showing the rectal cœcum. (Christchurch, in Hants S., Mr. C. Ashford).

The CEPHALIC RETRACTOR originates in the median-line, behind the lung, from three or more roots, which immediately unite to form a simple slender band, and divides usually but not invariably about half-way. There is considerable variation in the details of the furcation; usually the BUCCAL and TENTACULAR branches separate at nearly the same point, but sometimes the slender buccal branch is an offshoot of one or other of the tentacular retractors, or may arise from the main-muscle before the tentacular forking. The buccal retractor is always deeply divided in English forms, but not usually down to its origin or root, as Dr. Simroth states is the case in the German specimens.

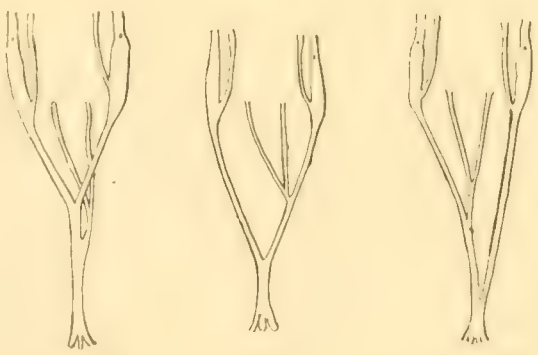


FIG. 120. FIG. 121. FIG. 122.

Cephalic retractors of *A. agrestis*, × 2, exemplifying the variations to which they are liable.

FIG. 120, represents an usual form. FIG. 121, a less usual arrangement. FIG. 122, the unusual.

The REPRODUCTIVE ORGANS have their orifice about two mill. behind the right ommatophore; the OVOTESTIS is comparatively enormous, and laid upon the upper surface of the digestive gland, the acini being light-brown, with darker connective tissue; DUCT short and inflated, buff to creamy white, with a slender VESICULA SEMINALIS; ALBUMEN GLAND with few lobes, and of a light-brown or slate colour; OVISPERMATODUCT broad above, narrow below; OVIDUCT with ample folds, free oviduct short, with a yellowish glandular investment; SPERM DUCT slender above, more compact and broad below; VAS DEFERENS short, and entering penis-sheath laterally near the free-end; PENIS-SHEATH a broad, irregular, and medially constricted sac, with narrow outlet, distal-end with a claw-like digitate gland, which varies greatly in size and complexity, each segment or digit having on its concave side a row of papillæ. The lower half of the sheath contains a conical and fleshy SARCOBELUM or excitatory organ, which is often pigmented at the tip; the RETRACTOR is a short, broad band, arising from the lung floor, to the right of the mid-dorsal line, anterior to both kidney and pericardium, and is attached, not to the apex, but to the middle of the penis-sheath at the same side as the point of entry of the vas deferens; SPERMATHECA fusiform or claviform, attached closely to the base of the oviduct, stem slender, and opening into the narrow and thick-walled ATRIUM, at the junction of the oviduct and penis-sheath.

FIG. 123. FIG. 124. FIG. 125.

General and detailed illustrations of the reproductive organs of *Agriolimax agrestis*.

FIG. 123.—Flagellate penial gland, showing two of the many variations to which it is liable, × 6.

FIG. 124.—Reproductive organs, × 2. *alb.g.* albumen gland; *at.* atrium, with protractor muscles; *fl.* flagellate gland; *ov.* ovotestis; *ov.d.* oviduct; *p.s.* penis-sheath; *r.* penis-retractor; *sp.* spermatheca; *sp.d.* sperm duct.

FIG. 125.—Penis-sheath laid open, showing point of entry of the vas deferens and the internal structure of the organ, × 4. *sb.* the sarcobelum or excitatory organ (after Simroth).

The MANDIBLE or jaw is crescentic in shape, with well and bluntly-rounded ends; it is a millimetre or more in width, moderately arcuate, of a yellowish-brown colour, and smooth in texture, but showing several distinct darker lines parallel with the upper and lower margins; median beak or rostrum not prominent, but somewhat acute, its vertical carina not well marked.

FIG. 126.—Mandible or jaw of *A. agrestis*, × 16. (Callander, Perth S., Mr. A. Somerville).

The LINGUAL MEMBRANE of a Perthshire specimen is 4 mill. long, and 1½ mill. wide; the denticles diminishing in size towards the outer margins; median teeth with a narrow, posteriorly-expanded base of attachment, the reflection narrow and distinctly tricuspid, the mesocone slender and projecting beyond the basal plate, the ectocones well developed with distinct cutting points; the asymmetrical laterals each have a moderately slender mesocone, the ectocone is also strongly and acutely developed, but the endocone is more or less obsolete, though becoming stronger towards the margin, the seventeenth tooth being distinctly tricuspidate; the marginals are distinctly aculeate, with an incipient ectocone on some of the teeth.

The formula is $\frac{16}{1\text{-}2} + \frac{19}{3} + \frac{1}{3} + \frac{19}{3} + \frac{16}{1\text{-}2} \times 118 = 8{,}378$.

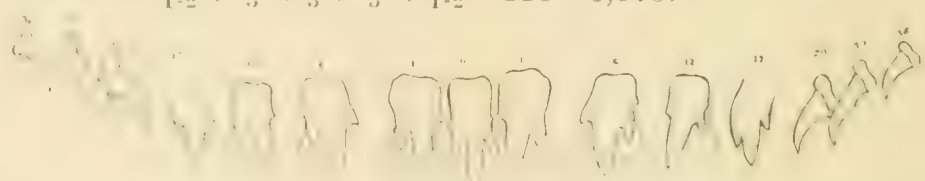


FIG. 126.—Representative denticles from a transverse row of the lingual teeth of *A. agrestis*, × 160. The animal collected by Mr. A. Somerville, at Callander, Perth S., and the lingual membrane prepared by Mr. J. W. Neville.

Reproduction and Development.—Unlike its ally *A. lævis*, which in the course of its sexual development is so markedly proterogynous, our *A. agrestis* shows a distinctly proterandrous tendency.

It is a species easily excited to sexual impulse, and very prolific, multiplying with great rapidity and under favourable circumstances breeding almost continuously throughout the summer months, producing numerous generations, as renewed intercourse may take place three or four days after a period of egg-deposition; a pair kept in confinement were actually depositing their third batch of eggs before the first were hatched, and a single pair have been observed by Leuchs to deposit the enormous number of seven hundred and seventy-six eggs during the season.

The act of conjugation usually takes place in the evening throughout the whole year, even when the thermometer verges upon freezing point, though more freely indulged in during the summer months, and is always preceded by a prolonged circular procession, which, through seasonal or other influences, may continue for only half-an-hour, or may be persisted in for one hour or more; during this performance milky slime is copiously given off, forming thick circular patches, one or two inches in diameter, which afterwards indicate the spot where congress has taken place.

Animals seeking to pair, on approaching each other, immediately begin the circular promenade, the head of the one animal being laid upon or in contact with the tail of the other, the animals gradually getting closer together, and stroking and patting each other with the exserted excitatory organ or sarcobelum, which is waved about excitedly in a ludicrous manner, and agitated in many sportive ways; the animals also fondle and caress with their tentacles, or even entwine together the anterior part of their bodies, these blandishments leading up eventually to the final consummation, which is very transient, not usually occupying more than a few seconds, during which period the seminal element, mixed with mucus and worked up into a little ball, is transferred bodily, the forerunner of a true spermatophore.

The eggs are usually round, pellucid, bluish-white, and about two mill. in diameter, but vary somewhat in both size and shape, even in the same batch. They may be found at all seasons of the year, even in January, Van Beneden especially remarking that they are deposited all through the winter months. They are placed under stones and rubbish, beneath fallen trees, and other moist and shady places, usually in clusters, which vary in number from about twelve to forty, or even more, and are said to be laid fourteen to twenty days after sexual intercourse, but according to Mr. E. J. Lowe, who has kept this species in captivity, only five days usually elapse before egg deposition takes place. The hatching occurs in three or four weeks' time, varying somewhat according to the weather.

The young grow very rapidly, doubling their size and weight in a week's time, and even growing during the winter months if the cold is not too severe, attaining sexual maturity, pairing, and depositing eggs at a very early age; one pair was observed to breed and deposit eggs in sixty-six days from the time of hatching, although full growth was not reached until the animals were eighty-two days old. Their life cycle or period has not been accurately ascertained, but in a state of nature does not appear to exceed eighteen months.

Economic Uses.—This species was formerly and is even yet in rural districts much sought after as a cure for consumption and other diseases of the lungs and chest.[1] They may be employed in the form of a broth, or

1 Monog, i., p. 428.

eaten alive by those who wish to obtain all the benefits that may be derivable from this reputed remedy.

For throat and chest affections a poultice of slugs is also said to be very emollient and curative.

Puton records that the peasantry of the Vosges regard *A. agrestis* as a reliable barometer, and that the greater viscosity and abundance of the body mucus, evidenced by the adhesion thereto of earth, leaves, and other extraneous substances, is a sure sign of approaching rain.

Food and Habits.—*Agriolimax agrestis*, though essentially a ground slug, inhabits a great variety of situations, not only frequenting gardens, fields, and hedgerows, but also living in woods and forests, by dusty roadsides, in marshy districts, and in the close vicinity of, or even within, houses and out-buildings.

The most curious, though doubtless temporary, habitat, is that vouched for by Mr. W. Nelson, who in April 1866 observed numbers of these animals crawling freely about beneath the water, at the bottom of Pebble Mill Pool, Birmingham; many of them were a considerable distance from the margin, and all were moving about in an ordinary way.

Its food is as varied as its habitats, as it is a truly omnivorous species, nothing edible seeming to come amiss, and when food to its liking is available its voracity and appetite seem insatiable; in such cases it has been known to eat the night through without intermission.

It is exceedingly destructive in the garden, its ravages not being confined to any particular plant or even to leaves, flowers, and fruit, as it devours the roots with almost equal avidity; like *Arion hortensis*, it is very partial to strawberries, and is especially destructive to peas, devouring not only the young shoots, but even the pods.

In the fields the havoc wrought by this pest amongst oats, clover, peas, tares, etc., is sometimes so great as to necessitate the re-sowing of the crop, and almost entitles it to a place amongst the locusts, rats, mice, and other plagues which at intervals devastate the country, and against which various prayers and ecclesiastical exorcisms[1] were formerly employed. The Ritual of Paris, A.D. 1712, which includes the slugs amongst the "worms," contains definite formulas for such exorcisms.

Efficacious practical means for destroying this slug have been earnestly sought for, and many methods have been devised which are more or less successful in their object.

Quicklime, sawdust, soot, tan, ashes, chaff, and sand are amongst the substances recommended to be spread over the ground they frequent; these substances when dry are impassable by slugs, as the multitudinous particles adhere to the animals, which vainly endeavour by the exudation of fresh mucus to get rid of the annoyance, and ultimately become exhausted and die.

Another method is to attract them to a circumscribed spot by sprinkling slices of potato, little heaps of oatmeal, cabbage, or other leaves, with or without greasy matter spread over their surface. The slugs are attracted by the baits, and rest upon or near them, so are readily found and destroyed during the frequent visits that must be paid to the traps.

Although not usually a fungus feeder, *A. agrestis* will, like the true Limaces, at times feed upon various kinds of fungi, poisonous and edible, *Boletus edulis*, *Amanita muscaria*, and *A. phalloides*, being especially mentioned.

1 Monog., i., p. 431.

Animal food is also eagerly eaten, this species having been observed to devour hop-aphides (*Phorodon humuli*), may-flies, the young of *Succinea putris*, etc., while in America Mr. J. Ford records that a number of *A. agrestis*, enclosed in a box with several *A. campestris*, immediately set upon and devoured their congeners—a veritable act of cannibalism.

They will also on opportunity feast upon dead or moribund earthworms, butterflies, and animals of their own or other species, nor does any kind of animal or vegetable refuse come amiss, as even animal excrement provides them with some nourishment.

A. agrestis is a pugnacious and very active species, and on a smooth path can crawl two inches per minute, or at the rate of a mile in twenty-two days ten hours; it also slips easily through the fingers when grasped, owing to the abundance of its thick milky-white slime, which exudes from any part of the body that may be touched, this exudation, however, varies in abundance according to the animal's necessities; when crawling over moist ground the secretion of mucus is not excessive, but when travelling upon a dry or absorbent surface, when surprised by the sun's rays, or as a defence against enemies, the mucus is more plentifully secreted, and this demand under certain circumstances may be so great as to totally exhaust the vitality of the animal, numbers being sometimes found dried up upon the whitewashed or plastered walls of country houses, where they have happened to be surprised by the sun's rays when crawling over the exposed absorbent walls.

The plenitude of this viscous secretion renders this species a good spinner of the mucous filaments, by means of which descent can be made from elevated positions. It does not appear to be sufficiently recognized that the phenomenon of thread-spinning is not due to a special secretion for this particular purpose, but is merely the slime which would be exuded in the ordinary way for the purpose of locomotion, and is consequently only the usual slime track freed from contact with the ground or neighbouring objects.

During descent by means of this mucus-thread, which *A. agrestis* has been observed to produce at a rate varying up to five inches per minute, the locomotory area of the sole is in active undulatory movement, exactly as in crawling, and the suspended animal revolves more or less quickly. It is one of the readiest spinners amongst our native species, and can descend from considerable heights, and if necessary is able to reascend by the same thread. Mr. Henry Crowther once observed a specimen near Truro, in Cornwall, descending from the branch of an elm-tree twelve feet from the ground, and the slug had descended seven feet of this distance when discovered.

It is the spinning *Limax* of Latham, but not the *Limax filans* of Hoy, which was described as "*Limax (filans) cinereus margine flavo*," peculiarities more applicable to some species of *Arion*.

A. agrestis is nocturnal in habit, but like its congeners ventures forth also during the day if it be damp and showery. In dry weather and during the day it hides away in secluded spots, beneath stones, under clods of earth, in worm-holes, etc., sometimes penetrating six or eight inches into the earth.

It is a very hardy species, only retiring for protection when the temperature verges on the freezing point, promptly reappearing at the advent of milder weather, and being active through the winter, except during the actual prevalence of frost

Protective Resemblance.—Few observations have been made with respect to the protection this species may derive from simulating other animate or inanimate objects, but it has been suggested that there is a striking resemblance between this animal and the bloom-sheaths of the black poplar (*Populus nigra*), and also that the pale forms show a marked approximation in appearance to the cocoons of the Burnet moth (*Zygæna filipendulæ*), this approximation being so close that at a short distance the resemblance seems complete; these, however, are probably only accidental cases of similarity, and can scarcely be compared with the remarkable examples of protective resemblance due to natural selection.

Parasites and Enemies.—Though the enemies of this species are very numerous, its enormous fecundity enables it under ordinary conditions not only to maintain its ground, but to increase in numbers.

M. Barthelmy affirms that a minute Nematode worm (*Ascarioides limacis*) is found even within the egg; while M. Laurent claimed to have detected a minute parasitic fungus therein, even before exclusion from the parent slug.

The active *Trichomonas limacis* Duj., and the rotifer *Albertia vermicularis* are found within the intestinal canal of adults, and the hair-worm (*Mermis nigrescens*) in the body cavity, while at one time *A. agrestis* was regarded as the most probable medium through which the dreaded scourge *Distomum hepaticum* was conveyed to sheep and other ruminants.

Ducks, rooks, pheasants, quail, etc., feed eagerly upon *A. agrestis*, a food to which the fieldfare also seems particularly partial.

They are favourite morsels with the hedgehog, which often scratches them out from the crevices or from the roots of grass where they are concealed; while the Blindworm (*Anguis fragilis*) is said to prefer this slug to any other food, and in captivity will take four or five or even more at a meal.

Fossil.—*Agriolimax agrestis* has been recorded in the fossil state from many localities, and from many of the deposits belonging to the Post-Tertiary periods, but as the specific characters are not sharply defined on the vestigial shell, the identifications probably cannot in every case be implicitly relied on.

Pliocene.—Mr. J. C. Mansel-Pleydell reports it as a Pliocene fossil from Dorset, but it is not included by Kennard & Woodward amongst the Pliocene fossils of the south of England.

Pleistocene.—Kennard & Woodward record it from Fisherton, in Wiltshire, and also from Portland, Dorset, the specimens from the latter locality having been identified by Dr. Jeffreys. In Sussex, Mr. J. P. Johnson found it in deposits on the foreshore at West Wittering. In Kent, Kennard & Woodward chronicle its presence in the Ightham fissure, in the Happaway Cavern, at Swanscombe, Crayford, and Erith; while the Rev. R. Ashington Bullen records it from a pre-neolithic chalky-loam deposit on the Barton Court estate, Buckland, near Dover. In Essex, Mr. J. P. Johnson has found it in the Uphall brickyard, Ilford, and Mr. Miller Christy reports it as common in the Camm Valley alluvium at Cliignal; it has been reported from Copford, and also occurs in the Palæolithic river drift at Grays, from which place it was formerly recorded as *Limax sowerbyi*. Kennard & Woodward state, on the authority of Dr. Jeffreys, that it has been found between Upton and Chilton, in Berkshire: and Mrs. McKenny Hughes reports it from the deposits at Barnwell Abbey, Cambridgeshire; Sandberger (Vorwelt, p. 755) vouches for its occurrence in this country

in the Lower Pleistocene Forest bed at Cromer, in East Norfolk, and also from the Upper Pleistocene gravels and brick-earths.

In France it has been found at the base of the Loëss, in the Pleistocene fluviomarine sand (sable aigre) of Menchecourt, near Abbeville, in the department of the Somme.

In Germany, Sandberger reports it from the Middle Pleistocene tufa at Cannstadt, Wurtemburg; and Spiridion Brusina cites it as a Pleistocene fossil in Moravia.

Holocene.—In Kent, this species has been found in deposits at Buckland, near Dover, by Rev. R. Ashington Bullen; it has also been tabulated or recorded for Maidstone, Charing, Darenth, Otford, Greenhithe, Exedown, near Wrotham, and from alluvium at Seal, near Sevenoaks, by Kennard & Woodward. In Surrey, the Rev. R. Ashington Bullen found it abundant up to three feet deep in Colley Pit, Reigate. In Essex, it has been found in the Lea Valley, at Witham, Braintree, Raine, Roxwell, Shalford, and in the alluvium at Walthamstow, according to Kennard & Woodward, who also record the finding of it by Dr. Frank Corner, in Post-Pliocene alluvium, at New Park, near the White House in the Lea Marshes. In Berkshire it has been found abundantly in beds of the Kennet Valley, Newbury, by Mr. E. Percy Richards.

Mr. G. E. Mason, in 1896, found many specimens of the shell within Mitchelstown Cave, Tipperary, mixed amongst the fine red earth on the floor of the "Long Cave," 600 feet from the entrance.

In Germany, Sandberger records it from the Löess at Unterdürnbach, and Unterzell near Würzburg in Bavaria, and also at Grotzingen near Durlach in Baden. It has also been recorded by Pini from the alluvium of San Fedele, near Milan, in Lombardy, and by von Ihering in the tufa at Streitberg in French Switzerland.

Variation. — *Agriolimax agrestis*, though usually offering a pallid colouration, does, under certain environmental conditions, present very varied pigmentation, and in this country, according to Dr. Norman, undergoes seasonal variation, the individuals though perhaps creamy-white or light-drab in the early part of the year, as the summer passes away assuming a darker hue, with brown flakes more or less thickly scattered over the surface, and during the autumn frequently becoming of a rich brown colour.

The markings to which the species is subject are invariably constituted by irregularly distributed dark spots, or blotches, which occasionally more or less overspread the whole body, and may at times become accidentally ranged into some semblance of longitudinal banding.

This absence of true banding renders it probable that the various banded slugs which have been referred to *A. agrestis* by various authors, would be more correctly allocated with *Limax tenellus*, *L. arborum*, or other normally banded species.

According to Dumont & Mortillet, the pale varieties are peculiar to forests and shady places, while those living in open situations are always darker in colour.

The variations in size are usually not very striking, but Mr. L. E. Adams has observed that those found on the coast always attain a larger size than those frequenting more inland localities, and Rev. S. Spencer Pearce especially remarked upon the diminutive size of specimens found at altitudes of 7,000 and 8,000 feet in the Engadine, Switzerland, while Kaleniczenko distinguished as var. *minuta* the stunted forms inhabiting the Pontic region.

Towards the confines of its natural range *A. agrestis* usually presents a more uniformly dark and, according to Simroth, more primitive colouring than in the British Isles, and it is extremely significant that this ancient garb should be the salient character of the species when living in countries beyond and almost encircling our most active evolutionary area, this peculiar distribution rendering it likely that the unicolorous forms at one time occupied this area, but have been supplanted by the distinctly maculate forms which now predominate there.

About Tromso and its more northern Norwegian habitats the species is usually of an uniformly pale brown; in southern and extreme south-western Europe it assumes a more or less uniform reddish, blackish, or dark-grey hue; while in south-eastern Europe, Asia Minor, and Turkestan, a grey form with or without faint spottings is the prevalent type.

This remarkable uniformity in colouring is associated with and may be in some measure correlated with the presence of a stronger and more extended keel, as this feature has been observed in the Norwegian, South European, Portuguese, and Asiatic specimens.

Although as far as possible all the names given to the various forms are enumerated, and their characters pointed out when ascertainable, yet many of them are practically identical or denote quite insignificant variations, and are included solely with the object of rendering the account of the species as complete as possible.

VARIATIONS IN COLOUR OF ANIMAL.

Var. **albitentaculata** Dum. & Mort., Moll. Sav., 1857, p. 10.

Limax agrestis var. *albitentaculata* Dum. & Mort., op. cit.
Agriolimax agrestis var. *alba* Cockerell, Nautilus, Oct. 1891, p. 70.

ANIMAL with body and tentacles pure white.

Dorset—Portland, Aug. 1886 ! J. Madison.
Isle of Wight—(G. Guyon in Venables' Guide to Isle of Wight, 1860, p. 462).
Sussex W.—Ratham, usually small, July 1884, W. Jeffery.
Middlesex—Bedford Park, Chiswick, amongst *Carduus arvensis* with type (T. D. A. Cockerell, Sci. Gossip, Jan. 1887). Churchyard-bottom wood, Highgate, May 1889, H. Wallis Kew.
Worcester—Garden, Stourport, July 1888 (Williams, J. of Conch., July 1888).
Stafford—Field, Stafford, Dec. 1885 ! L. E. Adams.
Lincoln N.—Claythorpe, July 1887 ! J. E. Mason.
York N.E.—Farwath Bridge, Aug. 1886 ! W. Denison Roebuck.
York Mid W.—By the walls of Clapham churchyard (H. Richardson, J. of C., April 1886). Bolton Abbey, April 1883 ! W.D.R.
Lancashire S.—Walton-le-Dale, June 1889 ! W. H. Heathcote.
Durham—Lane near Old Elvet, Durham, April 1884 ! Baker Hudson.
Lanark—Wilderness Wood, Cadder, Aug. 1886 ! W.D.R.
Down—Graveyard, Downpatrick Cathedral, and about Dundrum, R. Welch.
Dublin—Under a heap of hay, Raheny (Scharff, Slugs of Ireland, 1891, p. 527).
Tipperary S.—Near Clonmel, April 1888, A. H. Delap.
Sweden—Shore of Kärrstorp Lake, Ronneby (Westerlund, Mal. Iaktt., 1866, p. 553
Finland—Nykyrka in South Finland (Luther, Moll. Finland, 1901, p. 48).

Var. **pallida** Schrenk, Land u. Sussw. Moll. Livlands, 1848.

Limax pallidus Schrenk, op. cit.
Limax agrestis γ *filans* Moquin-Tandon, Hist. Moll. France, 1855, ii., p. 22.
Limax agrestis δ *melanocephalus* Moquin-Tandon, op. cit.
Limax agrestis var. *flavi-clypeus* Dum. & Mort., Moll. Sav., 1857, p. 10.
Limax agrestis var. *atritentaculata* Dum. & Mort., op. cit.
Agriolimax pallidus α *immaculatus* Less. & Poll., Mon. Limac. Ital., 1882, p. 51.
Limax agrestis var. *albidus* Vaniot, Moll. Amiens, 1883, p. 3.

ANIMAL pale and unspotted; SHIELD often tinged with yellowish.
The sub-var. **melanocephala** is greyish-white, with a black head.
The sub-var. **atritentaculata** is described as white with black tentacles.
The sub-var. **albida** is greyish-white.
The sub-var. **immaculata** is pale and unicolourous, with yellowish shield.
The sub-var. **filans** is whitish, shield yellowish or ash coloured.
The sub-var. **flaviclypea** has the shield yellowish.

This variety, which is the typical unicolorous form of the species, with the constituent subsidiary and scarcely separable forms cited above, is abundant and generally distributed throughout the British Islands, and probably occurs throughout the entire range of distribution of the species.

Var. **flavilatera** Dum. & Mort., Moll. Savoie, 1857, p. 10.

Limax agrestis var. *succineus* Westerlund, Faun. Europ., 1876, p. 11.
Agriolimax agrestis γ *aurata* Less. & Poll., Monog. Limac. Ital., 1882, p. 49.
Limax agrestis var. *xanthosoma* Fischer, J. de Conchyl., 1880, p. 294.

ANIMAL with body and shield yellowish.

The var. **flavilatera** s.str. is described as having the sides of body yellowish.
The sub-var. **succinea** is described as subrufous above and white beneath.
The sub-var. **aurata** has an uniformly yellow shield and body and black ommatophores.
The sub-var. **xanthosoma** is uniformly amber-yellow, tentacles bluish-brown.

Lancashire S.—Tyldesley, Aug. 1886, Lionel E. Adams.

France—Sub-var. *xanthosoma*, valley of Mont Dore, Puy-de-Dôme (Fischer, op. c.).

Italy—Sub-var. *aurata*, Groscovallo, Piedmont (Less. & Poll., op. cit.).

Norway—Sub-var. *succinea*, Christiania (Esmark, Suppl. Norway List, 1880).

United States—Sub-var. *succinea*, Portland, Oregon, H. F. Wickham (T. D. A. Cockerell, Nautilus, 1891).

Var. **cineracea** Moquin-Tandon, Hist. Moll. France, 1855, ii., p. 23.

Limax agrestis β *cineracea* Moquin-Tandon, op. cit.
Limax agrestis var. *cinerascens* Dum. & Mort., Moll. Sav., 1857, p. 10.
Limax agrestis var. *grisea* T. D. A. Cockerell, Nautilus, Oct. 1891, p. 70.

ANIMAL more or less entirely ash coloured or grey.

The var. **cineracea** s.str. is described as greyish-white with ash-coloured shield.
The sub-var. **cinerascens** is described as grey.
The sub-var. **grisea** is of a somewhat dark grey.

Lancashire S.—Sub-var. *grisea*, Knowsley near Liverpool, 1893 (W. E. Collinge, J. of Mal., June 1893). Near Prescot, Sept. 1885, T. D. A. Cockerell.

Dublin—Sub-var. *grisea*, Rathfarnham (Scharff, Slugs of Ireland, 1891).

France—Sub-var. *cinerascens* is recorded for Savoy; the var. *cineracea* is also found commonly almost throughout the department of the Ain; it is commoner than the type about Lyons in the department of the Rhone, and is also found in Haute Loire and the department of the Seine.

Portugal—Common in Estremadura, in Alemtejo and in Algarve (Morelet, Moll. Port., 1845, p. 35).

Greece—Sitia and Canea in the Isle of Crete (Simroth, op. cit.).

Norway—About Tromso, Groto, and Grono (Esmark & Hoyer, Mal. Bl., 1856).

Asia Minor—Magnesia, Brussa, and shores of the Dardanelles (Simroth, op. cit.).

Var. **violacea** Gassies, Moll. de l'Agenais, 1849, p. 64.

Limax agrestis ζ *lilacina* Moq.-Tand., Hist. Moll. France, 1855, ii., p. 22, pl. 2, f. 22.
Limax agrestis var. *plumbea* Standen, Irish Nat., Sept. 1898.

ANIMAL purplish, lilac or slate coloured.

This is probably the *Limax sylvaticus* of Draparnaud, but some of the details of his description are not in perfect accord with the characteristics of the species.

Somerset S.—Bridgwater, Aug. 1884 ! W. Vinson.
Sussex W.—Midhurst, 1884, T. D. A. Cockerell.
Middlesex—Bedford Park, Chiswick, Dec. 1884 ! T. D. A. Cockerell.
Stafford—Stafford ! L. E. Adams. Gardens, Cheadle, April 1886 ! F. B. Webb.
Salop—St. Oswald's Well and Whittington Castle, June 1885 ! Baker Hudson.
Gloucester E.—Stroud, Oct. 1883 ! E. J. Elliott.
Gloucester W.—Stroud, Oct. 1883 ! E. J. Elliott.
Monmouth—Shirenewton Hall, June 1886 ! E. J. Lowe.
Glamorgan—Llandaff, on *Dactylis glomerata*, July 1885 ! F. W. Wotton.
York N.E.—Egton Bridge, Aug. 1885 ! Baker Hudson. Coxwold and Byland, Sept. 1892 (Nat., 1892, p. 347).
York Mid W.—Cracoe, June 1891 ! W.D.R.

Ireland—Rev. B. J. Clarke records the not unfrequent occurrence of this variety in Ireland, but does not cite precise localities.

Down—Graveyard, Downpatrick Cathedral, R. Welch.

Dublin—Sub-var. *plumbea*, abundant on high road, Whitechurch near Dublin (Scharff, Slugs of Ireland, 1891, p. 528).

Waterford—Near Clonmel, April 1888, A. H. Delap.

Tipperary S.—Near Clonmel, April 1888, A. H. Delap. Cormack's Chapel, Cashel, May 1898, R. Welch.

Galway E.—Clonbrock, June 1900, R. Welch.

Kerry—Sub-var. *plumbea*, Glengariff road, Kenmare, July 1898 (Standen, Irish Nat., Sept. 1898).

France—(Moquin-Tandon, op. cit.). Common at Arès and Piquey in Aquitaine (J. B. Gassies, Mal. Aquitaine, 1867, p. 117). South of Amiens in the Somme (Vaniot, Moll. Amiens, 1883, p. 3).

Greece—Sitia and Canea in Crete (Simroth, op. cit.).

Var. **rufescens** Dum. & Mort., Moll. Savoie, 1857, p. 10.

ANIMAL with rufous body coloration.

Cheshire—Mere Bank, Knutsford, Oct. 1885 ! J. G. Milne.

Galway W.—Aran Isles, Oct. 1890, R. F. Scharff.

Greece—Canea in Crete (Simroth, op. cit.).

Portugal—Amongst rushes bordering streams or growing in the moist plains (Morelet, Moll. Port., 1845, p. 34).

Var. **brunnea** Taylor.

Agriolimax agrestis ζ *tristis* L. & P., Mon. Lim. Ital., 1882, p. 50 (not of Moq.-Tand.).

ANIMAL almost uniformly brown on body and shield.

Kent W.—Banks of River Cray, St. Mary Cray, April 1885 ! S. C. Cockerell. Hever, Edenbridge, Feb. 1898 ! A. Leicester.

Middlesex—Acton, Dec. 1884 ! T. D. A. Cockerell.

Norfolk W.—Garden, King's Lynn, Nov. 1886 ! C. B. Plowright.

Gloucester W.—Stroud, Oct. 1883 ! E. J. Elliott.

Stafford—Garden, Cheadle, April 1886 ! F. B. Webb.

Salop—Oswestry, June 1885 ! Baker Hudson.

Radnor—Pen-y-bont, Nov. 1893 ! F. Hall.

Glamorgan—Banks of River Ely, St. Fagan's, March 1885 ! F. W. Wotton.

Montgomery—Etail-wag, June 1885 ! Baker Hudson.

Lincoln N.—Tothby Farm near Alford, April 1886 ! W.D.R.

Derby—Buxton, June 1893 ! C. Oldham.

Notts.—Railway embankment, Colwick, Sept. 1884 ! Beauvale Abbey, Sept. 1884 ! Worksop, April 1884 ! and Wollaton, Nov. 1884 ! C. T. Musson. Garden, Tuxford, April 1885 ! W. A. Gain.

Cheshire—Bowdon, Dec. 1884 ! J. G. Milne. Sale and Northenden, June 1885 ! C. Oldham.

Lancashire S.—Whalley, Sept. 1888 ! C. Oldham. Walton-le-Dale, June 1889 ! W. H. Heathcote.

Lancashire Mid—Preesall near Fleetwood, Lionel E. Adams.

York S.E.—Garden, Westwood, Beverley, Sept. 1884 ! J. D. Butterell.

York N.E.—Battersby near Great Ayton, Dec. 1884 ! Baker Hudson.

York Mid W.—Starbotton, May 1886 ! W.D.R. Pry House near the dale head in Nidderdale, plentiful, May 1886 ! W.D.R. Common about Harrogate (F. R. Fitzgerald, J. of Conch., Jan. 1889).

Durham—Durham, April 1884 ! Baker Hudson.

Westmorland and Furness—Coniston, Sept. 1886 ! W.D.R.

Roxburgh—Bridge over Leader Water, Aug. 1886 ! W.D.R.

Berwick—Fans near Earlston, common, Oct. 1883 ! R. Renton.

Dumbarton—Near Duntocher, Sept. 1888 ! A. Shaw.

Ross E.—Near Bonar Bridge, Feb. 1887 ! W. Baillie.

Sutherland E.—Mound Rock, Sept. 1884 ! W. Baillie.

Hebrides—Stornoway, Isle of Lewis, Aug. 1886 ! A. Somerville.

Derry—Magilligan and Castle Rock, R. Welch.

Antrim—Whitehall, Broughshane, June 1886 ! Rev. S. A. Brenan.

Down—Clonduff, Jan. 1898, R. Welch. Cultra, Dec. 1891, R. F. Scharff.

Kildare—River bank, Monasterevin, Oct. 1899, R. Welch.

Queen's Co.—La Bergerie (B. J. Clarke, Annals N.H., 1840, p. 203).

Mayo W.—Annagh Bay, Achill Island, Aug. 1886 ! J. G. Milne.

Galway W.—Aran Isles, Oct. 1890 (Scharff, Slugs of Ireland, 1891, p. 527). Roundstone, March, 1891, R. F. Scharff.

Tipperary S.—Near Clonmel, April 1888 ! A. H. Delap.

Italy—Var. *tristis* Less. & Poll., about Auronzon near Cadore in Venetia, at Monte St. Elia in Calabria, and about Palermo in Sicily (Less. & Poll., op. cit.).

Norway—Uniformly pale brown specimens abound at Tromso, 70° north lat. (B. Esmark, Moll. Arct. Norw., 1882, p. 97).

VARIATIONS IN MARKINGS OF ANIMAL.

Var. **punctata** Picard, Moll. Somme, 1840, p. 164.

Limax agrestis var. *punctulatus* Dum. & Mort., Cat. Moll. Savoie, 1857, p. 10.
Limax veranyanus Bourg., Spic. Malac., 1861, p. 30, pl. 13, f. 9.
Limax agrestis ζ *florentinus* Less. & Poll., Mon. Limac. Ital., 1882, p. 50.
Limax agrestis var. *bimaculata* T. D. A. Cockerell.

ANIMAL greyish or whitish, sprinkled with fine black spots.

The sub-var. **punctulata** is described as sprinkled with black.

The sub-var. **veranyana** Bourg. appears hardly to differ from typical *punctata*, except in the greater number and smaller size of the spots.

The sub-var. **florentina** Less. & Poll. is described as eighty or more millimetres in length, and adorned with blackish-brown spots.

The sub-var. **bimaculata** is described as possessing pale ochre-brown spots on the shield, and greyish ones on the body, with pale-brown tentacles.

Dorset—Sub-var. *bimaculata*, Parkstone, T. D. A. Cockerell.

Hants S.—Var. *punctata*, Christchurch, Nov. 1883 ! C. Ashford.

Worcester—Var. *punctata*, garden, Stourport, July 1888 (Williams, J. of Conch., July 1889).

Pembroke—Var. *punctata*, near Pembroke, June 1885 ! Mrs. Trayler.

Notts.—Var. *punctata*, garden, Tuxford, Sept. 1885 ! W. A. Gain.

Dublin—Sub-var. *bimaculata*, plentiful in garden, Leeson Park, Dublin, in November (Scharff, Slugs of Ireland, 1891, p. 527).

France—In the departments of the Ain, Haute Loire, and the Seine. Sub-var. *veranyana* in shady places of the valleys throughout the mountain chain in the Alpes Maritimes.

Italy—Sub-var. *florentina* was found by Marchese Paulucci, at Castellonchio, at Novoli, and at Legnaia near Florence (Less. & Poll., op. cit.). Sub-var. *veranyana* is chiefly found about Genoa (Bourg., op. cit.).

Var. **reticulata** Müller, Verm. Hist., 1774, ii., p. 10.

Limax reticulatus Müller, op. cit.
Limax agrestis var. η Férussac, Hist., 1819, pl. 5, f. 7.
Limax agrestis λ *sylvaticus* Moq.-Tand., Hist. Moll. France, 1855, p. ii., p. 23, pl. 3, f. 2.
Limax agrestis ζ *obscurus* Moquin-Tandon, op. cit.
Limax agrestis var. *subreticulatus* Dum. & Mort., Cat. Moll. Sav., 1857, p. 10.
Limax agrestis var. *maculatus* Dum. & Mort., Cat. Moll. Sav., 1857, p. 10.
Agriolimax pallidus β *fusconotatus* L. & P., Mon. Limac. Ital., 1882, p. 51, pl. 1, f. 6.

ANIMAL with a variable ground tint, with irregular dark spots and interstitial lineolation.

The sub-var. **sylvatica** is described by Moquin-Tandon as of variable ground colour, with irregular spots, the head often of a clear brown. The var. η of Férussac is quoted as synonymous.

The sub-var. **maculata** is described as irregularly spotted.

The sub-var. **subreticulata** is described as having the interstitial lineolation more diffuse.

The sub-var. **fusconotata** Less. & Poll. has brown spots, or is subreticulate upon a pale ground colour.

The sub-var. **nigricans** Westerlund is described as grey, with somewhat coalescent black spots and dark tentacles.

The sub-var. **obscura** is described as reddish with brown spots.

The var. *reticulata* and its sub-varieties really represent the most prevalent type, being probably found in every locality where the species exists in the British Isles.

Var. **nigra** Morelet, Moll. Port., 1845, p. 34.

Limax agrestis α *niger* Morelet, op. cit.
Limax agrestis var. *nigrescens* Colbeau, Mal. Belg., 1859, p. 7.
Agriolimax panormitanus Less. & Poll., Mon. Limac. Ital., 1882, p. 52, pl. 1, f. 5.
Limax agrestis var. *azorica* Ckll.

ANIMAL entirely or almost entirely black, the colour sometimes invading the side-areas of the sole, as in *Limax cinereo-niger*, but the black pigment may be discharged by immersing the animal in liquor potassæ, the body then becoming of a rich brown colour.

The sub-var. **panormitana** L. & P. differs externally only in the colouring tending to olive-brown, and internally is said to show a more digitate penial gland.

Hants N.—Preston Candover, Oct. 1886 ! H. P. Fitzgerald.

Sussex W.—Ratham, April 1889 ! W. Jeffery.

Gloucester E.—Stroud, March 1884 ! E. J. Elliott.

Gloucester W.—Stroud, Oct. 1883 ! E. J. Elliott.

Notts.—Roadsides, Mapperley, May 1885 ! and Beauvale Abbey, Sept. 1884 ! C. T. Musson. Garden, Tuxford, June 1888 ! W. A. Gain.

Stafford—Gardens, Cheadle, April 1886 ! F. B. Webb. Croxden Abbey (J. R. B. Masefield, Staffordshire List, 1902).

Derby—Clifton, June 1889, L. E. Adams.

Radnor—Pen-y-bont, Nov. 1903 ! F. Hall.

Merioneth—Gardens, Palé, Corwen, May 1887 ! T. Ruddy.

Pembroke—North Cliff, Tenby (A. G. Stubbs, J. of Conch., July 1900).

Lancashire S.—Knowsley near Liverpool (W. E. Collinge, J. of Mal., June 1893). Farington, June 1890 ! W. H. Heathcote.

York S.E.—Pansy-beds in garden, Westwood, Beverley, May 1884 (J. D. Butterell, J. of Conch., Jan. 1883).

York N.E.—Egton Bridge, Aug. 1885 ! Baker Hudson. Skelton Beck Valley, near Saltburn, May 1887 ! and roadsides, Raskelf, Oct. 1882 ! W.D.R.

York S.W.—Garden, Holmfirth, Jan. 1885 ! H. E. Craven. Garden, Wakefield, Jan. 1885 ! J. Wilcock. Bottoms, Heckmondwike, Mch. 1903 ! T. Castle. Apperley Bridge, and in gardens near Peel Park, Bradford (Soppitt & Carter, Nat., 1888, p. 97). Penistone (L. E. Adams, Nat., Oct. 1893, p. 315).

York Mid W.—Wood near Tadcaster, F. G. Binnie (J. Darker Butterell, J. of Conch., Jan. 1883). Near Manchester Hole, Nidderdale, July 1886 ! Kettlewell, May 1886 ! and abundant at top of Greenhow Hill, Wharfedale, April 1887 ! W.D.R.

York N.W.—Bolton Castle, Wensleydale, May 1888 ! W.D.R.

Durham—Durham, May 1887 ! Rev. H. E. Fox.

Wigtown—Springbank near Stranraer, Sept. 1890 ! W. Evans.

Haddington—Dirleton Common, North Berwick, Sept. 1890 ! W. Evans.

Antrim—Cave Hill, near Belfast, 1893, R. Welch.

Leitrim—Drumshambo, Dec. 1901, J. Welch.

Waterford—Near Clonmel, April 1888, A. H. Delap.

Belgium—Var. *nigrescens*, Brussels (Colbeau, Mal. Belg., 1859, p. 7).

Spain—Var. *panormitana*, Gibraltar (Simroth, op. cit.).

Portugal—Var. *nigra*, common in Estremadura, in the Alemtejo, and in Algarve (Morelet, Moll. Port., 1845, p. 34).

Italy—Var. *panormitana*, Palermo, Sicily (Simroth, op. cit.).

Spain—Gibraltar (Simroth, op. cit.).

Greece—Var. *panormitana*, Canea in Crete (Simroth, op. cit.).

Azores—The black form of this species, the var. *panormitana* of Simroth, is found above the zone of cultivation, and has been distinguished as var. *azorica* by Cockerell, to emphasize the widely distant place of its evolution, but as no differences are known, either externally or internally, I am unable to agree with the application of a distinctive name to the Azorean individuals merely on account of their remote insular locality.

Geographical Distribution.—*Agriolimax agrestis* is very widely distributed over the whole Palæarctic region, and has been carried by commerce to North and South America, South Africa, Australia, Tasmania, New Zealand, and the Mauritius.

In the United States this species is steadily spreading, owing to the great amount of intercommunication between the different states, and it will doubtless ultimately oust the aboriginal species with which it may come in competition.

ENGLAND AND WALES.

In the case of this species we are able to dispense with the necessity of giving details for the various districts, inasmuch as throughout the whole of England and Wales it is abundantly and generally diffused, from the coast-level even to the summits of the hills, and there is probably not a plot of cultivated ground on which it is not to be found, it being absent

or scarce only on such inhospitable ground as peaty moorlands, pine forests, etc. We have seen and authenticated examples from all the counties and vice-counties into which the country is divided.

SCOTLAND.

This species has been found and its occurrence also authenticated in each of the forty-one districts into which the country has been separated for record purposes, a result due in great measure to the indefatigable energy with which Mr. W. Evans obtained examples for us from all the out-lying or more inaccessible districts.

IRELAND.

The investigation of Ireland is not yet so far advanced as in the sister countries, so that it is desirable to give the detailed distribution.

ULSTER.

Derry—Swarming about Coleraine, Nov. 1883, L. E. Adams. Ballynagard, June 1892, D. C. Campbell (R. F. Scharff). Creagh meadows, Toome, and many other places, R. Welch.

Antrim—Cushendun and Whitehall, Broughshane, May 1886 ! Rev. S. A. Brenan. Hill Slenish, 700-800 feet alt. ! W. F. de Vismes Kane. Common about Belfast, Dec. 1891, R. F. Scharff. About Ballycastle, but not abundant, Sept. 1896 (R. Standen, Irish Naturalist, Jan. 1897). Ram's Island, Lough Neagh, R. Welch.

Down—Cultra, Dec. 1891, R. F. Scharff. Crawfordsburn near Glen Head, May 1902; about flax-dam, Ballinahinch Junction, March 1899 ; Slieve Bingian, alt. 1,200 feet, also at an alt. of 1,250 feet at Deer's meadow, Mourne Mountains, Jan. 1898, R. Welch.

Armagh—Armagh, June 1885 ! H. W. Lett.

Monaghan—Common about Clones Round Tower graveyard, Oct. 1901, R. Welch.

Tyrone—Strabane, June 1889, A. H. Delap. Dungannon, May 1901, R. Welch.

Donegal—Donegal, Sept. 1885 ! W. F. de V. Kane. Croaghross, Letterkenny, May 1889 ! H. C. Hart.

Fermanagh—Common about Enniskillen ; Marble Arch and throughout the Lough Erne area generally, R. Welch.

Cavan—In woods and shores of lake, near Killykeen, July 1896 (R. Welch, Irish Naturalist, Oct. 1896, p. 274).

LEINSTER.

Louth—Piperstown ! Miss Sidney Smith. Dundalk demesne, and also common in the Boyne valley, R. Welch.

Meath—Navan, June 1888 ! and New Grange, June 1892, R. F. Scharff. Beauparc ; Tara Hill, and Loughcrew Hills, July 1900, R. Welch.

Dublin—Banks of river Dodder at Rathfarnham, and Rathmines, April 1887 ! Leeson Park, Nov. 1890; Dundrum and Sherkin Island, R. F. Scharff. Cabragh Old road, Dublin, April 1886 ! J. R. Redding. Kingstown, May 1886 ! and Glen Druid, Carrickmines, Oct. 1886 ! W. F. de Vismes Kane. Ireland's Eye and Hill of Howth, R. Welch.

Kildare—Maynooth, Nov. 1891, R. F. Scharff. Monasterevin, Oct. 1899, R. Welch.

Wicklow—Powerscourt, May 1886 ! W. F. de Vismes Kane. Woodenbridge and the Arklow sand hills, March 1893 (R. F. Scharff, Irish Naturalist, April 1893). Glendalough, June 1901, R. Welch.

Wexford—Alderton near Kilmanock, Sept. 1888 ! Miss Glascott. Wexford, April 1891, R. F. Scharff.

Carlow—Common about Carlow, Nov. 1901, A. G. Stewart.

Queen's Co.—La Bergerie, common, and in all shades of colouring (B. J. Clarke, Ann. N.H., 1840, p. 203).

Westmeath—Knockdrin demesne, Ap. 1892, and Mullingar, Ap. 1894, R. F. Scharff.

Longford—Currygrane, Mrs. J. Mackay Wilson (Welch, Irish Nat., July 1902).

CONNAUGHT.

Leitrim—Dromahaire, Sept. 1900, R. Welch.

Sligo—Markree Castle demesne, Collooney, Aug. 1886 ! W. F. de Vismes Kane. Near Ballina, July 1891 ! Miss Amy Warren.

Mayo W.—Moyview, Ballina, July 1891 ! Miss Amy Warren. Enniscoe demesne, Crossmolina, Sept. 1885 ! J. G. Milne. Under stones on shore, Annagh Bay, and other places in Achill Island ; also at Westport and Newport, Sept. 1886 (id., J. of Conch., Oct. 1891). Common, Aasleagh, and Delphi, April 1897 (R. Welch, Irish Naturalist, Nov. 1897).

Galway W.—Roundstone, March 1891, and Aran Isles, Oct. 1902, R. F. Scharff. Dernasliggan near Leenane, April 1897 (R. Welch, Irish Nat., Nov. 1897).

Galway E.—Gardens about Tuam (B. J. Clarke, Ann. N.H., 1843, p. 341). Clonbrock, June 1886, R. F. Scharff.

MUNSTER.

Tipperary S.—Clonmel, April 1888, A. H. Delap. Common, Cashel and Holycross, May 1898, R. Welch.

Waterford—Waterford, Sep. 1883 ! J. H. Salter. Clonmel, Apl. 1888, A. H. Delap.

Cork S.—Abundant at Blarney, Bantry, and Glengariff, Sept. 1898, L. E. Adams. Clear Island, Dec. 1889, Queenstown, May 1891, R. F. Scharff.

Kerry—Very common on Valentia Island, Apl. 1888, A. H. Delap. Lough Caragh, June 1890, R. F. Scharff. Swarms about Galway's Bridge, Kenmare, July 1898 (R. Standen, Irish Nat., Sept. 1898). Abundant at Killarney, Sept. 1898, L. E. Adams.

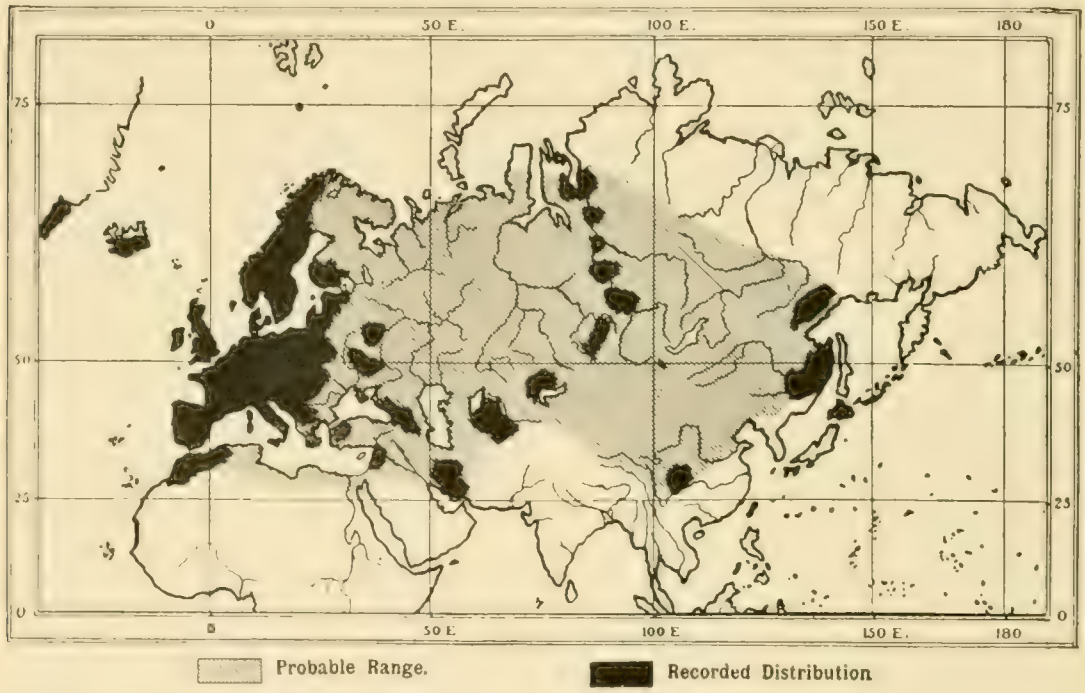


FIG. 127.—Geographical Distribution of *Agriolimax agrestis* (L.).

GERMANY.

Found throughout the empire, and records have been seen for Alsace, Baden, Bavaria, Brandenburg, Coburg, Franconia, Hanover, Holstein, Lüneburg, Nassau, Pomerania, Prussia, Pyrmont, Saxony, Silesia, Thuringia, Westphalia, Wurtemburg, and the Island of Heligoland.

NETHERLANDS.

Belgium—(Colbeau, Mal. Belg., 1859).

Holland—(R. J. Maitland, Nachrichtsbl., 1869, p. 163).

FRANCE.

A. agrestis is probably found throughout France, and has been reported from the Ain, Aisne, Alpes Maritimes, Aquitaine, Ariége, Basses Pyrénées, Champagne Meridionale, Charente Inférieure, Côte d'Or, Côtes-du-Nord, Finistère, Gard, Gers, Gironde, Hautes Alpes, Haute Garonne, Haute Loire, Hautes Pyrénées, Haute Savoie, Hérault, Ille-et-Vilaine, Isère, Jura, Loire Inférieure, Lozère, Maine-et-Loire, Manche, Morbihan, Moselle, Nièvre, Nord, Oise, Pas-de-Calais, Puy-de-Dôme, Pyrénées Occidentales, Rhone, Savoie, Seine, Seine Inférieure, Seine et Marne, Somme, Var, Vendée, Vienne, Vosges, and the Island of Corsica.

SWITZERLAND.

Probably abundant throughout the country, and has been reported as occurring in the cantons of Berne, Grisons, Glarus, Lucerne, Neuchatel, St. Gall, Solothurn, Valais, Vaud, and Zurich.

ITALY.

Recorded as inhabiting the whole of Italy and its islands. In its various forms, which include Eichwald's variety *iberus* and Issel's variety *etruscus*, of which the descriptions have not been accessible, it has been reported from Calabria, Emilia, Liguria, Lombardy, Piedmont, Rome, Tuscany, Umbria, Venetia, and the Islands of Capri, Sardinia, and Sicily.

AUSTRO-HUNGARY.

Has been found in Austria, Bosnia, Bohemia, Galicia, Goritz, Hungary, Istria, Slavonia, Styria, Transylvania, Tyrol, and Upper Carinthia.

SPAIN AND PORTUGAL.

Spain—Graells says it is found in various provinces. It has been definitely recorded from near Santiago in Galicia; from Barcelona and Olot in Catalonia; from Lorca in Murcia; from the White Mountain in Aragon; as common in garden at Valencia; and Mr. E. J. Lowe found it common in May 1860, at Hoy de Barcena near Santander in Old Castile; while the var. *panormitana* is recorded by Simroth from Gibraltar in Andalusia.

Portugal—Simroth reports this species from Lisbon and Cintra in Estremadura, Coimbra in Beira, and Braga and Oporto in Minho. Morelet records the varieties *nigra* and *cinerea* as common in Estremadura, Alemtejo, and Algarve, and the var. *rufescens* as living in various moist places.

Balearic Isles—Plentiful in Majorca, Minorca, etc.

BALKAN PENINSULA.

Servia—(Heynemann, Jahrb. Deutsch. Mal. Ges., June 1885, p. 254).
Montenegro—Cettinje (Clessin, Nachrichtsbl., 1885, p. 179).

SCANDINAVIA.

Norway—Very common throughout Norway, extending even to Kistrand, 70° 25′ north lat.; it abounds also about Tromso at 70° north lat. In these northern regions, however, the animals scarcely exceed an inch in length, and according to Miss Esmark are mostly uniform light-brown in colour, but grey specimens are also found, as well as maculate ones.

Sweden—Very common throughout, and extending to the extreme northern confines of the country, being recorded by Westerlund for Karesuando in Swedish Lapland at 68°-69° north lat.

Denmark—(Heynemann, op. cit.). Müller records his *Limax reticulatus* from gardens in Fridrichsdal and Rosenburg.

It is also recorded for **Greenland, Southern Iceland** and the **Faroes.**

RUSSIA.

Has been recorded from Courland, Livland, Esthland, Moscow, Kharkov, Poltava, Tchernigov, Crimea, Poland, Abchasia, and according to Luther is common throughout Middle and Southern Finland.

Siberia—Westerlund gives numerous localities along the whole valley of the Jenissei from Kolmogorowa in the south, 59° 30′ north lat., where the examples were strongly maculate; the finely spotted varieties were more boreal in their distribution, but not met with beyond Baklanovskaia at 64° 50′; still further to the north, the pale, immaculate form only was found, and extended as far as Selivaninskoj, 65° 55′ north lat. It has also been recorded by F. Schmidt as found on Brjochow [or Bregovski] Island in the estuary of the Jenissei at 70° 50′.

On the Lower Amur, Schrenk found it abundant about Dshare, Nikolajevsk, and on the Island Uïsut in the Liman or estuary of the Amur. Maack found it on the banks of the Ussuri, a tributary of Amur, and Middendorff found a small slug in the Stanowoi Mountains which Schrenk regarded as this species (Sibir. Moll., 1877).

MONGOLIAN SUB-REGION.

Turkestan—*Limax fedtschenkoi* is said to be peculiar to the district between Aral and Kokhand (Westerlund, Sib. Moll., 1877, p. 13).

China—*L. setchuanensis* Heude, which is probably a synonym of *A. agrestis*, is moderately abundant in the mountains of Tchen-k'eou, the province of Se-Chuen (Heude, Moll. Terr. Fleuve Bleu, 1885, p. 99).

Japan—Probably the *Limax varians* of A. Ad., from Hakodadi, Refunsiri, and Risiri are really referable to *Agriolimax agrestis.*

NORTH AFRICA, ASIA MINOR, Etc.

Morocco—(Scharff, Slugs of Ireland, 1891, p. 528).

Algiers—Tlemcen in Oran (Morelet, J. de Conch., 1853, p. 280). Upper Kabylie (Locard, Moll. Lyons, 1877).

Asia Minor—Haifa in Syria (Morelet, Journ. de Conch., 1853, p. 280). Brussa and the shores of the Dardanelles (Simroth, op. cit.).

Persia—(Scharff, Slugs of Ireland, 1891, p. 528).

ATLANTIC ISLES.

Madeira—Common on cultivated land about Funchal and on the west of the island (R. Boog Watson, Journ. de Conch., 1876, p. 221).

Canaries—Plain of Laguna, Teneriffe (Férussac, Hist., 1819, p. 74). Santa Cruz and Orotava, Teneriffe, Lt.-Col. Parry (Collinge & Partridge, J. of Mal., May 1899).

Azores—In gardens at Ponta Delgada, and elsewhere, San Miguel (Simroth, op. cit., 1891, p. 281).

NEARCTIC REGION.

According to Pilsbry, *A. agrestis* is found in most large cities on the Atlantic coast, and has put in an appearance at several points on the Pacific slope; it has been recorded definitely for

Ontario—Abundant at Mackay's Bay, New Edinburgh, and other places about Ottawa (F. R. Latchford, Mollusca Ottawa, 1886, p. 12). St. Thomas, July 1887 (T. D. A. Cockerell, J. of Conch., Oct. 1889).

Quebec—Citadel, Quebec (F. R. Latchford, Amer. Nat., Nov. 1885).

British Columbia—Vars. *sylvatica* and *varians* in gardens, Victoria, Vancouver Isle, first observed about 1884 (G. W. Taylor, Nautilus, Dec. 1891).

Maine—Common in fields and by road-side near villages, and abundant in cellars and gardens in Portland (Morse, Terr. Pulm. Maine, 1864, p. 7).

Massachusetts—Garden, New Bedford, introduced (Thomson, J. of Conch., Oct. 1885). Boston (W.G.Binney, Land and Freshwater Shells of N. Amer., 1869, p. 64). Plentiful in gardens, Cambridge (Weinland, Weichth. Schwab., 1876, p. 25).

New York—New York (W. G. Binney, Terr. Moll. of N.A., 1878, vol. 5, p. 147). Abundant in gardens, Plattsburgh, G. H. Hudson, 1885. Onondago Co., W. M. Beauchamp, 1885. Monroe Co., introduced by J. Walton, 1898.

New Jersey—Burlington (T. D. A. Cockerell, Nautilus, Jan. 1890).

Pennsylvania—Westchester, Chester Co., W. D. Hartmann, 1885. Philadelphia (W. G. Binney, Proc. Acad. Sci. Philad., 1886, p. 392).

Michigan—Gardens, Agricultural College, near Lansing, under an old log on Cedar river bank, possibly imported with greenhouse plants, Prof. R. H. Pettit (Bryant Walker, Moll. Michigan, 1899, p. 21).

Ohio—Cincinnati (Harper and Weatherby, Cat. Cincinn. Moll., 1876).

Colorado—Introduced at West Cliff, Custer Co., from Burlington, New Jersey (T. D. A. Cockerell, Nautilus, Jan. 1890).

California—Abundant in San Francisco (W. M. Wood, Nautilus, Dec. 1891). Oakland (W. J. Raymond, Nautilus, Jan. 1892).

Oregon—Vars. *sylvatica*, *varians*, and *succinea*, Portland, H. F. Wickham (T. D. A. Cockerell, Nautilus, Oct. 1891, p. 71).

NEOTROPICAL REGION.

Brazil—(Scharff, Slugs of Ireland, 1891, p. 528).

Jamaica—Cinchona (T. D. A. Cockerell, J. of Mal., June 1893, p. 153).

ETHIOPIAN REGION.

Zanzibar—Zanzibar coast (Heynemann, Jahrb.D.M.G., 1885, p. 293).

Cape Colony—Cape Town (Melvill & Ponsonby, Proc. Mal. Soc., Dec. 1898).

Mauritius—(Férussac, Hist. Suppl., 1823, p. 96e).

AUSTRALASIAN REGION.

New South Wales—Under stones at Darling Point, G. Neville; and at Tamworth (C. T. Musson, Proc. Linn. Soc. N.S.W., 1890, p. 891).

Victoria—Melbourne, Mr. Kershaw (C. T. Musson, op. cit.).

New Zealand—Recorded for Auckland, Wellington, and Greymouth in the North Island; and from Nelson, Christchurch, Dunedin, etc., in the South Island (C. T. Musson, op. cit.).

Tasmania—As *Limax legrandi* Tate.

Distribution of *Agriolimax agrestis* (L.)

In the Counties and Vice-Counties of the British Isles.

ENGLAND AND WALES.

Channel Isles

PENINSULA
1 Cornwall W.
2 Cornwall E.
3 Devon S.
4 Devon N.
5 Somerset S.
6 Somerset N.

CHANNEL
7 Wilts N.
8 Wilts S.
9 Dorset
10 Isle of Wight
11 Hants S.
12 Hants N.
13 Sussex W.
14 Sussex E.

THAMES
15 Kent E.
16 Kent W.
17 Surrey
18 Essex S
19 Essex N.
20 Herts.
21 Middlesex
22 Berks.
23 Oxford
24 Bucks.

ANGLIA
25 Suffolk E.
26 Suffolk W.
27 Norfolk E.
28 Norfolk W.
29 Cambridge
30 Bedford
31 Hunts.
32 Northampton

SEVERN
33 Gloucester E.
34 Gloucester W
35 Monmouth
36 Hereford
37 Worcester
38 Warwick
39 Stafford
40 Salop

SOUTH WALES
41 Glamorgan
42 Brecon
43 Radnor
44 Carmarthen
45 Pembroke
46 Cardigan

NORTH WALES
47 Montgomery
48 Merioneth
49 Carnarvon
50 Denbigh
51 Flint
52 Anglesey

TRENT
53 Lincoln S.
54 Lincoln N.
55 Leic. & Rutld.
56 Notts.
57 Derby

MERSEY
58 Cheshire
59 Lancashire S.
60 Lancashire Mid

HUMBER
61 S.E. York
62 N.E. York
63 S.W. York
64 Mid W. York
65 N.W. York

TYNE
66 Durham
67 Northumb. S.
68 Cheviotland

LAKES
69 Westmorland and L. Lanes.
70 Cumberland
71 Isle of Man

SCOTLAND.

W. LOWLANDS
72 Dumfries
73 Kirkcudbright
74 Wigtown
75 Ayr
76 Renfrew
77 Lanark

E. LOWLANDS
78 Peebles
79 Selkirk
80 Roxburgh
81 Berwick
82 Haddington
83 Edinburgh
84 Linlithgow

E. HIGHLANDS
85 Fife & Kinross
86 Stirling
87 Perth S. & Clkn
88 Mid Perth
89 Perth N.
90 Forfar
91 Kincardine
92 Aberdeen S.

E. HIGHLANDS
93 Aberdeen N.
94 Banff
95 Elgin
96 Easterness

W. HIGHLANDS
97 Westerness
98 Main Argyle
99 Dumbarton
100 Clyde Isles
101 Cantire
102 Ebudes S.
103 Ebudes Mid
104 Ebudes N

N. HIGHLANDS
105 Ross W.
106 Ross E.
107 Sutherland E.
108 Sutherland W.
109 Caithness

NORTH ISLES
110 Hebrides
111 Orkneys
112 Shetlands

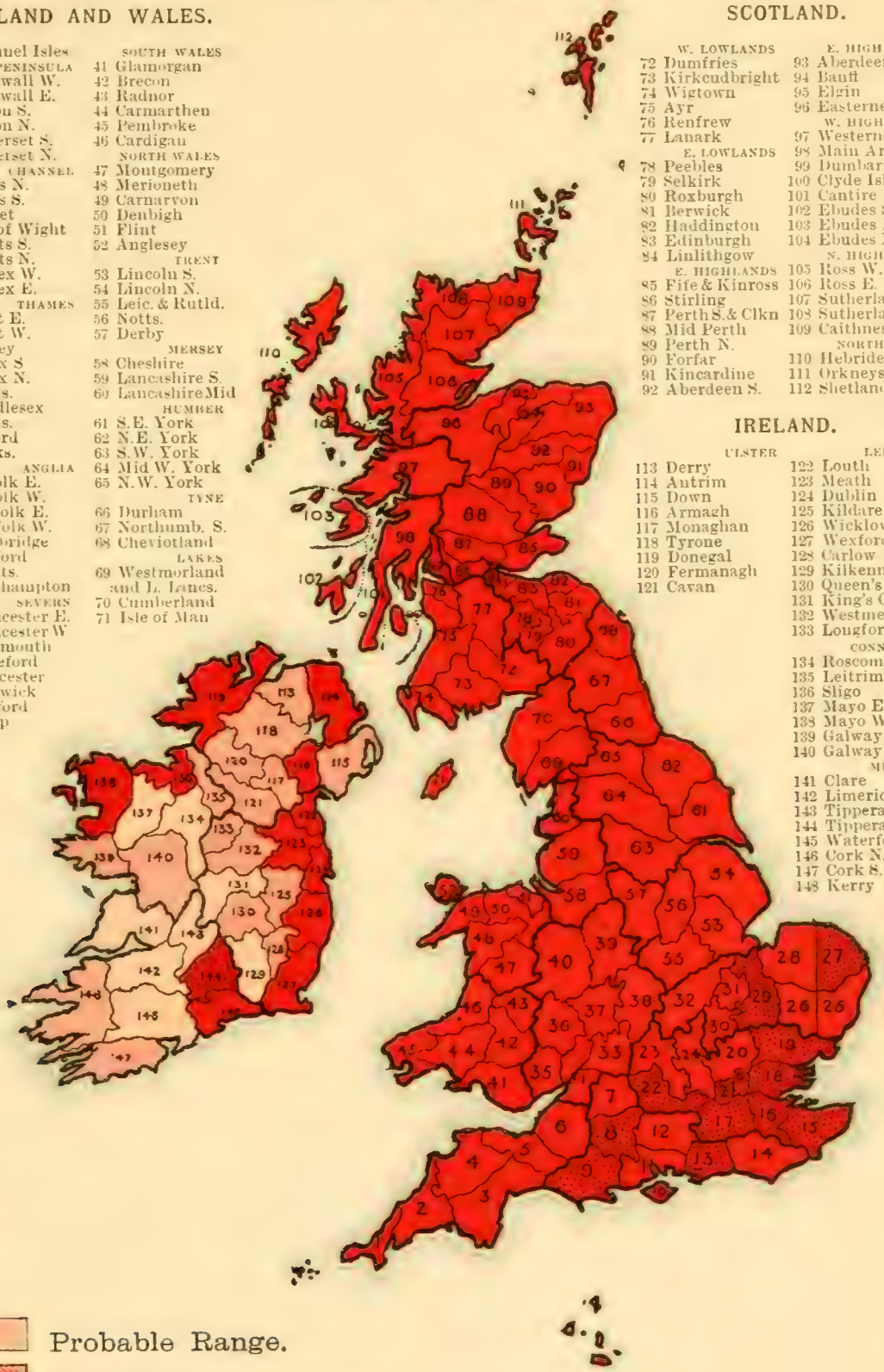
IRELAND.

ULSTER
113 Derry
114 Antrim
115 Down
116 Armagh
117 Monaghan
118 Tyrone
119 Donegal
120 Fermanagh
121 Cavan

LEINSTER
122 Louth
123 Meath
124 Dublin
125 Kildare
126 Wicklow
127 Wexford
128 Carlow
129 Kilkenny
130 Queen's Co.
131 King's Co.
132 Westmeath
133 Longford

CONNAUGHT
134 Roscommon
135 Leitrim
136 Sligo
137 Mayo E.
138 Mayo W.
139 Galway W.
140 Galway E.

MUNSTER
141 Clare
142 Limerick
143 Tipperary N.
144 Tipperary S
145 Waterford
146 Cork N.
147 Cork S.
148 Kerry



Probable Range.

Recorded Distribution.

Distribution verified by the Authors.

Fossil Distribution.

Sub-Genus *Hydrolimax* A. W. Malm.

Agriolimax lævis Müller.

1774 *Limax* **lævis** Müller, Verm. Hist., ii., p. 1, no. 199.
1801 — *brunneus* Drap., Tabl. Moll., p. 104, no. 13.
1822 — *lacustris* Bonelli, in Sched. Mus. Taurin.
1841 — *campestris* Binney, Proc. Boston Soc. Nat. Hist., p. 52.
1845 — *lombricoides* Morelet, Moll. Port., p. 39, pl. 3, f. 4.
1852 — *parvulus* Normand, Desc. Lim. Nouv., p. 8.
1867 — *arenarius* Gassies, Malac. Aquitaine, pp. 117-119, pl. 1, f. 1.
1874 — *argentinus* Strobel, Mal. Arg. Merid., p. 6.
1875 — *montanus* Ingersoll, Bull. U.S. Geol. Surv. Terr., p. 394.
1875 — *castaneus* Ingersoll, op. cit.
1875 — *ingersolli* W. G. Binney, Proc. Acad. Nat. Sci. Philad.
1876 — *hyperboreus* Westerlund, Nachsbl. d. Deutsch. Mal. Ges., p. 97.
1878 — *meridionalis* Doering, Bol. Acad. Cordoba, p. 434.
1880 — *stenurus* Strebel, Faun. Mexik. Conch., p. 21.
1885 — *brasiliensis* Von Ihering, Jahrb. Deutsch. Mal. Ges., p. 201, pl. 5.
1888 — *queenslandicus* Hedley, Proc. Roy. Soc. Queensland, p. 150, pl. 5.
1871 — (**Agriolimax**) *rarotonganus* Heyn., Nachbl. d. Deutsch. Mal. Ges., p. 43.
1882 *Agriolimax lævis* Lessona & Pollonera, Monog. Limac. Ital., p. 47.
1897 — *bevenoti* Collinge, Proc. Mal. Soc., vol. 2, p. 295.
1868 *Hydrolimax lævis* Malm, Limac. Skand., p. 79, pl. 3.
1868 *Krynickillus* (*Malino*) *brunneus* Mabille, Rev. et Mag. Zool., p. 141.
1887 *Krinickia brunneus* Fischer, Man. Conch., ii., p. 462.

J. F. Babor

HISTORY. — *Agriolimax lævis* (*levis*, smooth) was first discovered in this country by Mr. Joshua Alder, and its peculiar characters pointed out to Dr. G. Johnston, who published the discovery in 1838 in the Proceedings of the Berwickshire Naturalists' Club.

The species was, however, afterwards lost sight of, neglected or misunderstood, and became relegated to the ranks of doubtful species by Jeffreys, Reeve, and others, despite the persistent efforts of Mr. E. J. Lowe, F.R.S., to secure the recognition of its specific status.

The authoritative exposition of its internal structure by Dr. Simroth has firmly established *A. lævis* as a valid species, which is now universally recognized.

With this species is associated Dr. J. F. Babor, of Prague, whose profound researches, more especially upon *A. lævis*, have demonstrated the actuality of a remarkable cycle of changes in the development of the reproductive organs.

It was placed by Malm in a new genus, *Hydrolimax* (ὕδωρ, water, and *Limax*), which is here adopted in a sub-generic sense to mark the absence of the rectal cœcum and the digitate flagellum.

Diagnosis.—*A. lævis* may be distinguished from *A. agrestis* by its active and restless habits, its uniform red-brown colour, colourless mucus, the abrupt terminal end of the body, the large shield, and its nearly median position when the animal is fully extended, owing to the unusual length of the neck.

Internally, it is sharply divided from *A. agrestis* by the total absence of the rectatheca and of the digitate gland at the apex of the penis-sheath.

Description.—ANIMAL rather slender, glossy, and smooth, and of a peculiar semi-gelatinous consistency, usually of a reddish-brown or chocolate colour, and when contracted bearing a great resemblance to a short plump worm; BODY rounded, with some distinct and rather prominent tubercles; TAIL keeled; SHIELD large, rounded in front and behind, and somewhat paler in colour than the body, strongly concentrically ridged around a sub-central and laterally-placed nucleus; NECK very long, making the shield seem to be nearly centrally placed; TENTACLES black and very thick, with large black bulbs; FOOT longitudinally tripartite, light brown, with median area more transparent and apparently darker. The body MUCUS is abundant, clear and watery, but after continued irritation tends to become milky and turbid with minute particles of lime; the locomotory mucus is more viscid and tenacious.

SHELL oblong-oval in shape, and showing an indistinct oblique ridge from the apex to the anterior right side of the shell, corresponding somewhat to the gonial ridge[1] of the Pelecypoda; white and glistening, convex above, and correspondingly concave beneath; NUCLEUS distinct, and placed towards the left posterior angle of the shell; concentric lines of growth arcuate, numerous, and distinct; margins not broadly membranaceous. Length, 3 mill.; breadth, 1½ mill.

FIG. 129. — Internal shell of *A. lævis*, × 4. (Steeton, Yorks., Mr. F. Rhodes).

INTERNALLY, the body is darkly pigmented; the KIDNEY, HEART, and LUNG-CAVITY resemble those of *A. agrestis*; the AORTA runs a considerable distance before dividing into the cephalic and visceral branches; the lateral sinuses, especially that of the left side, are favourable for observation; they can be seen through the transparent skin to remain almost uniformly open without in the least answering to the pulsations of the heart, and are thus strictly venous; the supra-pedal gland extends quite the length of the body. The organ of Semper is composed of several oblong lobules, easily detachable on account of the tenderness of the skin; the OSPHRADIUM is indistinctly developed, but it can be traced to the middle of the lung chamber.

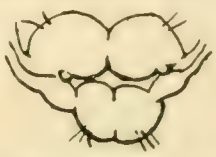


FIG. 130.—Underside of the sub-œsophageal ganglia of *A. lævis*, showing the otocysts, × 20. (Christchurch, Hants S.).

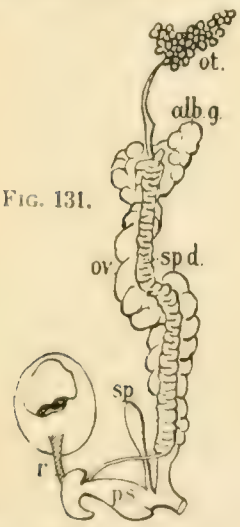


FIG. 131.

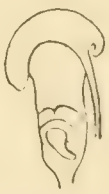


FIG. 132.—Penis laid open to show the excitatory organ, × 9 (after Simroth).

FIG. 133.

FIG. 134.

FIG. 131.—Sexual organs of *A. lævis*, greatly enlarged (after Simroth). *alb.g.* albumen gland; *ot.* ovotestis; *ov.* oviduct; *sp.d.* sperm duct; *sp.* spermatheca; *r.* retractor; *p.s.* penis sheath.

FIG. 133.—Alimentary canal of *A. lævis*, showing the adherent salivary glands, × 3 (after Simroth).

FIG. 134.—Cephalic retractors of *A. lævis*, × 12. (Armley, Leeds).

The REPRODUCTIVE ORGANS are very gelatinous and deeply pigmented; the OVOTESTIS is dark chestnut-brown, and acinose; its duct scarcely sinuous, mostly dark, with a pale VESICULA SEMINALIS; ALBUMEN GLAND deep yellow; OVISPERMATODUCT firmly united, whitish above, chestnut-brown beneath; FREE OVIDUCT short and glandular; VAS DEFERENS short, entering the penis-sheath nearly terminally; SPERMATHECA elongately oval, flesh-coloured, and attached to ovispermatoduct by a distinct apical muscle; PENIS-SHEATH of a peculiar hammer-like form and darkly pigmented, but occasionally in Europe, and invariably in America, is simply elongate; the sub-basal lateral protuberance contains the SARCOBELUM, or excita-

1 Monog. i., p. 45, f. 109.

tory organ, which differs from that of *A. agrestis* in being shorter and more faintly grooved; the PENIS-RETRACTOR is short, and arises from the lung-floor, considerably in front of the heart and the kidney in the European form, but is usually absent in *L. campestris* and its allies.

The ALIMENTARY CANAL somewhat resembles that of *A. agrestis*, but the INGESTIVE TRACT is still shorter, and the rectum is quite free of any cæcal process; the SALIVARY GLANDS are slender and rather deeply lobed; the LIVER is usually of a pretty moss-green colour; the right lobe forms the hinder end of the visceral mass, the left lobe is also quite forward and divided into a number of slender points or tips.

The RETRACTOR arises from the right side of the median line, behind the kidney, from a bifid or trifid root, which after a longish course unites into a slender band which furcates about mid-way; the BUCCAL retractors are quite slender and linear, while the TENTACULAR branches, though originating from the common stem as a slender band, soon become very bulky.

The MANDIBLE or jaw is of the usual crescentic form, with less produced limbs and much more prominent and convexly rounded rostrum or beak than in *A. agrestis*; the colour is brown, darkest along the upper margin and towards the extremities of the lateral limbs; the cutting edge is also finely serrate along its whole extent.

FIG. 135.—Mandible or jaw of *A. lævis*, × 20. (Armley, Leeds).

The LINGUAL MEMBRANE is elongate, about three mill. long, and one mill. broad, the transverse rows being arranged in arcuate form, bending distinctly backwards towards the margins; median row of teeth with well developed mesocone and ecto-

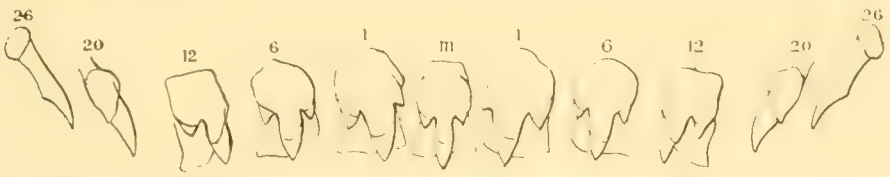


FIG. 136.—Representative denticles from a transverse row of the lingual teeth of *A. lævis*, × 240. The animal collected at Horsforth, Leeds, and the palate prepared by Mr. J. W. Neville.

cones; laterals also tricuspid, the first and twelfth with endocone quite obsolete or indistinct; marginals aculeate or with an ectocone more or less distinctly visible.

The dental formula of a Horsforth specimen shows

$$\frac{1}{1\text{-}2}\frac{6}{} + \frac{1}{2\text{-}3}\frac{2}{} + \frac{1}{3} + \frac{1}{2\text{-}3}\frac{2}{} + \frac{1}{1\text{-}2}\frac{6}{} \times 115 = 6{,}555.$$

Reproduction and Development. — The reproductive organs of *A. lævis*, and to some extent those of the *Limacidæ* generally, have been found by Dr. Babor to undergo a remarkable cycle of development, or series of metamorphoses, during which the individuals of this species, which are admittedly proterogynous, undergo a series of changes from their primitively unisexual and purely female condition to the hermaphrodite state, and afterwards become purely male by the atrophy of the female organs.

These wonderful mutations are demonstrated by the fact that most of the individuals found in spring are unisexual with a purely female organization, possessing gonads yielding ova only; later the examples show a budding of the male organs, so that in summer and early autumn the animals have become hermaphrodite, and present well developed organs of both sexes. The evolutionary process, however, does not cease with the full acquirement of the hermaphrodite state, as Dr. Babor has found that after a certain interval the female organs may atrophy and dwindle away, and the animal again become unisexual, but purely male, with gonads secreting spermatozoa only.

Even when the cycle is thus fully completed, it is not by any means certain that in some species the sequence of transformations may not be continued, and the rotation of sexes again take place.

The act of conjugation in this species has never been described, but it has been observed by Gassies, in the var. *arenaria*, to take place usually at

Fig. 137. Fig. 138. Fig. 139. Fig. 140. Fig. 141.

Reproductive organs of *Agriolimax lævis* Müll. × 6, illustrating the metamorphic changes to which they are subject (after Babor).

Fig. 137.—The organs in their earliest or solely female state.
Fig. 138.—The succeeding stage, showing the budding of the male organ.
Fig. 139.—The perfected hermaphrodite state.
Fig. 140.—The following period, showing the dwindling of the female organs in the process of becoming solely male.
Fig. 141.—The cycle of change completed, the female organs having disappeared, and the animal being solely male.

night, or during thunderstorms and tempestuous rains, and is known to be preceded by the circular procession and amatory flirtations which seem so characteristic of slugs generally, but this preliminary courtship is apparently in this species a very tedious and prolonged operation, as these blandishments have been observed to continue for more than an hour at a stretch without result.

The seminal element would appear to be transferred enclosed within a soft mucous capsule, of a somewhat triangular shape, which represents and acts as a true spermatophore, and is apparently formed in the outer or larger limb of the flagellum, which functions as a slime gland, while the smaller projection or limb when inverted functions as the intromittent organ.

Fig. 142.—Mucous sperm capsule, or spermatophore, of *A. lævis* (after Simroth).

The eggs are roundish, quite transparent, of somewhat leathery consistency, with a diameter varying between 1·3 and 2·8 millimetres, and are deposited either singly or in small clusters, held together by clear slime, in moist situations, all the year through. According to the observations of Gassies and others, they are laid at intervals of a day or more, three days after pairing, deposition extending over a period of six or eight days, and the total number being said not to exceed about thirty.

The hatching takes place in from twenty to forty days, the young when excluded being about three millimetres long and of a reddish colour, which gradually becomes of a browner shade, the animals attaining maturity in about seventy days.

Food and Habits.—*Agriolimax lævis* is the most active, restless, and fearless of our slugs, and even hardier than *A. agrestis*. If touched when crawling it has been observed to elevate the median part of its body, in a manner recalling the mode of progression characterizing the caterpillar of the Geometridæ, the mantle then appearing very protuberant.

It is also very pugnacious and aggressive, pulling off and devouring the slime from the bodies of the larger species, or withdrawing its tentacles and butting violently with its head against their bodies, at the same time protruding and rasping with the odontophore.

When these attacks, which may be twice or thrice repeated, take place, the slug assaulted usually shrinks, momentarily withdraws the head beneath the mantle, and then crawls hastily away; sometimes, however, the injured animal turns to repel the aggressor, which then, according to Mr. Kew, makes off with all speed, raising its tail and shaking it from side to side, and possibly striking therewith the head or tentacles of the pursuer, which, being thus temporarily disconcerted, enables the agile aggressor to escape more readily.

The favourite food of this species has not yet been discovered; Mr. Gain, who had many individuals under close observation for a long period, states that of the seventy-nine different kinds of food offered to it, although none were devoured with zest, thirteen were eaten more or less freely: of these, six were cultivated plants, the remaining seven being the foxglove, fleabane, crosswort, wallflower, red-robin, sow-thistle, and the fungus *Polyporus squamosus*.

Dumont & Mortillet allude to its fondness for animal matter, in pointing out that it may be procured by spreading bones in suitable spots, when the slugs can be readily found beneath them, devouring the gelatine softened by the moisture.

Herr Clessin has observed it in a state of nature feeding upon the pollen of the ox-eye daisy (*Chrysanthemum leucanthemum*), and Magnus records that the fertilization of that plant, during cold and damp weather, when insects are not abroad, has been actually brought about by *A. lævis* crawling over the flowers.

Although it is said in Germany also to frequent dry situations, *A. lævis* in this country is confined to the vicinity of water, and is almost invariably in company with *Zonitoides nitida*. Even when submerged by rising water *A. lævis* does not appear to be disturbed, as it has often been found resting immobile and unconcerned for several hours on the underside of logs, etc., quite immersed in the water.

Mr. F. J. Partridge at suitable times has found it living in company with *Succinea oblonga* in hollows of the sandhills at Braunton Burrows, which, though filled with water in winter and in wet weather, are in summer during the day nothing but a mass of hot dry sand.

During the day it is usually concealed in crevices, or beneath the dense tufts of *Marchantia polymorpha*, *Sphagnum*, and especially amongst the moss *Hypnum cuspidatum*, or may be found in the hollow stems of the Umbelliferæ growing in marshy places. When suspended in the aquarium *A. campestris* will, according to Mr. Latchford, at once descend to the bottom of the tank by means of a mucus cable, crawl with retracted tentacles towards the sides, which it ascends, opening the respiratory orifice upon reaching the surface.

A. lævis is an adept in forming slime-threads, and has been observed to form a mucus-thread, eight inches in length, in less than three minutes. M. Normand records that *L. parvulus*, which is synonymous with the present species, spun a filament over two yards in length.

Fossil.—According to Kennard & Woodward, *A. lævis* is known as a Pleistocene fossil from the deposits at Swalecliffe, about a mile west of Herne Bay, East Kent; it was also found in Middlesex, in the section dis-

closed by the excavations for the foundations of the Admiralty Buildings, Westminster. Mrs. McKenny Hughes reports it from the beds at Barnwell Abbey, in Cambridgeshire; and Mr. J. P. Johnson from a deposit on the foreshore, at West Wittering, Sussex; and also from the Uphall Brickyard, near Ilford, in South Essex.

Variation.—Dr. Simroth affirms that *A. lævis* is subject, under certain conditions, to seasonal variation or Horæomorphism, the var. *grisea* indicating the typical summer garb of the species when living on dry, cultivated lands. This light-grey form, which is occasionally blackish on the back, or may be tinged with reddish, is only found during the summer months and on warm and dry spots, but with the advent of the cool, damp days of autumn, they gradually change to the dark unicolorous winter variety, this change being regarded as a result of the greater degree of cold and moisture to which they are subjected at that season.

The examples, however, which dwell by the constantly cool and moist margins of rivers and pools are not subject to this change, retaining during life the dark uniform colouring typical of the species.

Dr. Simroth also traces a connection or correlation between the size of the mantle and the degree of moisture in the inhabited locality, the excess of moisture being said to cause a fuller swelling of the body and an exuberant growth of the mantle.

Dr. Baudon has described a monstrosity of this species as var. *intentaculata*, which was totally destitute of any trace of tentacles.

The world-wide distribution attained by this little species has led to a number of names being applied to it, which, according to Simroth and others who have especially studied the subject, merely indicate forms differing little from typical specimens, and at the most represent geographical races, in which latter category the American and Australasian forms may appropriately be placed.

VARIATIONS IN COLOUR AND MARKINGS OF ANIMAL.

Var. **lacustris** Bonelli, 1822, in Sched. Mus. Taurin.

Limax lacustris Bonelli, op. cit.
Limax lævis var. *maculata* T. D. A. Cockerell, J. of Conch., July 1886, p. 79.
Limax lævis var. *rufrapunctatus* W. E. Collinge, J. of Mal., Dec. 1898, p. 22.

Differs from the type in being irregularly spotted with dark brown.

Mr. G. E. Mason has observed that this variety is of more aquatic habits in Surrey than the typical form.

Surrey—Sub-var. *maculata*, marshy ground at north end of Barnes Common, 1886, T. D. A. Cockerell.

Warwick—Sub-var. *maculata*, sparingly (W. E. Collinge, J. of Mal., op. cit.).

Italy—Var. *lacustris*, Laghi d'Avigliana; Turin; Rivarossa Canavese and Lago d'Azeglio (Lessona & Pollonera, Monog. Limac. Ital., 1882, p. 48).

Var. **grisea** Taylor, var. nov.

ANIMAL light grey, with grey mid-sole and pale side areas.

Ireland—A greenish-grey variety on railway embankment in marsh, Downpatrick, County Down, March 1898, R. Welch.

Germany—Leipzig and Halle-am-Saale (Simroth, Zeitsch. Wiss. Zool., Aug. 1885).

Finland—(Simroth, Ber. Naturf. Ges. Leipzig, 1898, p. 39).

Var. **arenaria** Gassies, Malac. Aquitaine, pp. 117-119, pl. 1, f. 1.

Limax arenarius Gassies, op. cit.

ANIMAL greenish-bronze or blackish above; SHIELD paler and tending to dirty-yellow; NECK greyish-yellow paling towards the shield.

France—At margin of fish-pond, below the dunes at Lacanau, June 1860; on the high-road from Teste at Lamothe; also at Andernos, and under stones in the salt meadows at Teich, all in Aquitaine (Gassies, op. cit.).

VARIATIONS IN FORM AND SIZE OF ANIMAL.

Var. **mucronata** Westerlund, Fauna Europ., 1876, p. 12.

ANIMAL yellow-brown, sides paler, foot-sole white; SHIELD more pointed behind.

Sweden—Ronneby in Blekinge (Westerlund, op. cit.).

Norway and Denmark—(Heynemann, Jahrb. Deutsch. Mal. Ges., 1885, p. 248).

Var. **parvula** Normand, Desc. Limac., 1852, p. 8.

Limax parvulus Normand, op. cit.
Limax brunneus var. *pygmæus* Lowe, Conch. Notts., 1853, p. 156, f. 114.

The *L. parvulus* of Normand, to which may be allocated *L. brunneus* var. *pygmæa* of E. J. Lowe, is remarkable for its small size, which scarcely exceeds half-an-inch in adults when fully extended. They are described as paler than the typical form.

Notts.—*L. brunneus* var. *pygmæa*, not common under stones and at roots of sedges, at margin of lake, Highfield House, near Nottingham, and common at Beeston, E. J. Lowe.

France—*L. parvulus*, Valenciennes, Department of the Nord (Normand, op. cit.).

Belgium—*L. parvulus*, Chaudfontaine near Liège, June 1871 (Van-den-Broeck, Bull. Soc. Mal. Belg., 1871, p. li).

Geographical Distribution.—*A. lævis* as an aggregate form seems almost cosmopolitan in its distribution, being found not only throughout Europe, but has been recorded from South Africa, Siberia, Alaska, Canada, and the United States of North America.

It has also been reported from the West Indies, Central and South America, Australia, and Polynesia.

In the British Isles this species is apparently widely dispersed, and probably exists in every comital and vice-comital area into which the kingdoms are divided.

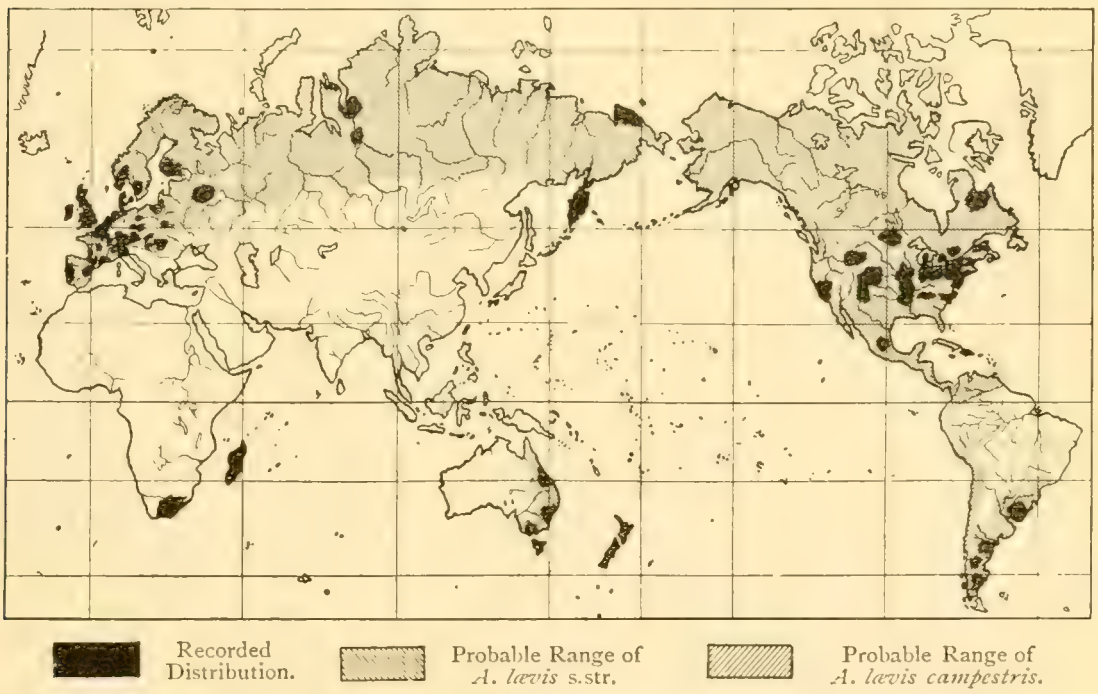


FIG. 143.—Geographical Distribution of *Agriolimax lævis* Müller.

ENGLAND AND WALES.

Channel Isles—Jersey (Duprey); Guernsey, in damp places (Tomlin & Marquand, J. of Conch., Jan. 1903, p. 286).

PENINSULA.

Cornwall W.—St. Ives, Sept. 1885! J. E. Mason.

Devon S.—Topsham and Exmouth, Aug. 1892! L. E. Adams.

Devon N.—Braunton Burrows near Bideford, F. J. Partridge.

Somerset N.—Among stone heaps by side of lane from Walton to Portishead, and among decaying vegetation by side of sluice on Portishead Moor (Norman, Moll. Somerset, 1860, p. 139).

CHANNEL.

Dorset—Wool, Mr. Kendall; among grass, Whatcombe Park (J. C. Mansel-Pleydell, Moll. Dorset, 1898, p. 4); Chideock, near Bridport (A. Belt, Sc. Goss., Aug. 1893).

Hants S.—Damp meadow by River Avon at Knapp Mill, Christchurch, Feb. 1885! C. Ashford. Hambledon and Beckford Green (L. E. Adams, Sc. Goss., Mch. 1901).

Sussex W.—Ratham, Aug. 1885! W. Jeffery.

THAMES.

Kent E.—Sandwich, Sept. 1891! L. E. Adams. Sittingbourne (E. W. Swanton, J. of Mal., June 1893, p. 146).

Kent W.—Banks of River Cray at St. Mary Cray, April 1885! and Greenhithe, June 1885! S. C. Cockerell.

Surrey—Wray Common, Reigate Heath, etc., 1885, E. Saunders. Godstone and Guildford, Sept. 1884, T. D. A. Cockerell. Barnes, June 1885, S. C. Cockerell. Punch Bowl near Haslemere, E. W. Swanton (C. Pannell, jr., J. of Conch., April 1902, p. 170).

Essex S.—Redbridge lane, Wanstead (W. Crouch, Essex Nat., Dec. 1890, p. 209). Woodford, 1889, H. Wallis Kew.

Essex N.—Common on flags by River Colne, Halstead, Aug. 1890, L. E. Adams.

Herts.—Ware, Dr. Jeffreys (J. Hopkinson, Moll. Herts., 1884).

Middlesex—Hanwell, Sept. 1884! T. D. A. Cockerell. Thames bank near Twickenham, March 1885! and Perivale, April 1885, S. C. Cockerell.

Oxford—Fairly common about Oxford; also found at Broughton Castle, Banbury; Chipping Norton; near Charlbury, and about Swincomb (W. E. Collinge, Conchologist, March 1891, p. 13).

Bucks.—Banks of River Ouse, above Olney, March 1893, L. E. Adams.

ANGLIA.

Suffolk E.—Plentiful in damp places about Woodbridge, June 1886, Rev. S. Spencer Pearce. Oulton, Mendlesham, Thwaite, Needham Market, and Sproughton (Mayfield, J. of Conch., April 1903).

Norfolk E.—Norwich (Bellars, British Shells, 1858). Diss and Cringleford, Aug. 1890, Lionel E. Adams. In the marsh-lands, Surlingham Ferry, Whitlingham, etc. (Pearce & Mayfield, J. of Conch., July 1894). Plentiful on marsh and ditch banks, Bramerton, Colney, Postwick, and Costessey (Mayfield, J. of Conch., 1896, p. 185).

Norfolk W.—Thetford, Aug. 1890, Lionel E. Adams.

Cambridge—Whittlesea (Bellars, British Shells, 1858). Rare, Grantchester, May 1886, B. Tomlin.

Northampton—Peterborough (Bellars, British Shells, 1858). Common on banks of River Nene and in damp places in woods (L. E. Adams, Journ. Northants Nat. Hist. Soc., 1893, p. 208).

SEVERN.

Gloucester E.—Woods between Cooper's Hill and Birdlip (Tate, Brit. Mollusca, 1866, p. 77).

Monmouth—Abundant in a damp portion of the park at Shirenewton Hall, Apl. 1886, E. J. Lowe.

Warwick—Mr. Thickbroom's woodyard, Sutton Coldfield (A. Wood, Moll. of Sutton Coldfield, 1897). Fairly common in marshy places, Sutton Park, H. Overton.

Stafford—In an old dingle near Stafford, Oct. 1885! Beresford Dale, Apl. 1890; abundant in wood by canal bank between Leek and Cheadle, April 1891, L. E. Adams. Stone, E. D. Bostock (Masefield's Staff. List, 1902). Newton road, Birmingham, July 1893! C. Oldham.

Worcester—Deep Meadow, Stourport, J. W. Williams.

SOUTH WALES.

Glamorgan—Banks of River Ely, St. Fagan's, March 1885! F. W. Wotton. Llandaff, etc., not very common (id., J. of Conch., April 1886, p. 54).

Pembroke—Common under stones and among the yellow Iris, Tenby (A. G. Stubbs, J. of Conch., July 1900).

NORTH WALES.

Montgomery—Timber yards, Welshpool, June 1889! and Pwllbrwynen near Llanwddyn, May 1889! (J. Bickerton Morgan, Montgomery List, 1891, p. 396).

Denbigh—Llandudno, May 1888, B. Tomlin.

Flint—Mostyn Marsh, July 1883! W.D.R.

TRENT.

Lincoln S.—Fulbeck Grange, Dec. 1888! J. B. Davy.

Lincoln N.—Sutton-in-the-Marsh, Haugham Wood, and Muckton Chalk Pit, April 1886! also Harrington Hill, Sept. 1889! W.D.R. Hubbard's Valley, Louth (C. S. Carter, Naturalist, 1904, p. 63).

Leicester—Leicester (Bellars, British Shells, 1858).

Notts.—Abundant in vicinity of lake at Highfield House near Beeston; also in garden of Broadgate House on organic soil in the valley, 1885, E. J. Lowe. Gamston, Sept. 1884! and in a wood at the Decoy, Houghton, April 1885! C. T. Musson. Pleasley Vale, Kirkby-in-Ashfield, etc. (Dodd, Brit. Assoc. Hdbk., 1893). Bawtry, Rufford, etc. (W. A. Gain, Brit. Nat., Nov. 1893).

MERSEY.

Cheshire—Chester (Bellars, British Shells, 1858). Common in gardens, etc., Heatley House, May 1885! L. E. Adams. Ashley near Bowdon, Sept. 1885! J. G. Milne. Between Warrington and Knutsford, Sept. 1885, T. D. A. Cockerell. Northwich, Oct. 1885! C. Oldham.

Lancashire Mid—Easegill Beck side, April 1887! W.D.R.

Lancashire S.—Whalley, June 1889! W. H. Heathcote. Common on the Southport sandhills (G. W. Chaster, Brit. Assoc. Hdbk., 1903).

HUMBER.

York S.E.—Leckonfield! Meaux! Risby, and banks of the River Hull (J. D. Butterell, J. of Conch., April 1882).

York N.E.—Thirsk (Tate, Brit. Moll., 1866, p. 71). Malton, Sept. 1880, J. D. Butterell. Levisham, abundant, Aug. 1886! Saltburn Woods, Oct. 1886! Skelton Beck Valley, May 1887! Wilton Wood, May 1887! and Ramsdale Wood, Robin Hood's Bay, June 1888! W.D.R. Airey Holme Wood (Baker Hudson, J. of Conch., April 1886). Kilton Castle, 1889! B. Hudson. Wass village, Sept. 1892! W.D.R. White Nab, J. A. Hargreaves.

York S.W.—Pontefract, April 1877 (Nat., May 1877). St. Swithin's, Stanley, 1883, Wakefield, Jan. 1885! also Ferrybridge, Haw Park, and Ryhill, J. Wilcock. Campsall Park, May 1886! and Cusworth, near Doncaster, Sept. 1901! W.D.R. Roydhouse Wood, Huddersfield! J. Whitwham. Common about Halifax in damp places in woods, J. E. Crowther. Garden, Rose Hill, Penistone; moderately common, Gunthwaite, and Cubley Wood, April 1890; also Doncaster, July 1892, L. E. Adams. Near Worsborough Reservoir, Sept. 1899! W. E. Brady. Wragby Brickpond near Ackworth, G. Roberts. Methley, Nostell, and Oulton (id., Nat. Hist. Lofthouse, 1885, p. 238).

York Mid W.—Banks of Leeds and Liverpool Canal at Armley, Kirkstall, Newlay, etc., Feb. 1882! W. Nelson. Also from Bingley to Steeton, July 1890! F. Rhodes. Stream-side, Hawkesworth Wood, Horsforth, April 1888! W.D.R. Shipley Glen and Fagley Wood (Soppitt & Carter, Nat., 1888, p. 97). Near Malham Tarn, Sept. 1883! Roebuck & Butterell. Kingsdale near Clapham, April 1887 (H. Richardson, J. of Conch., April 1886, p. 60). Helk's Wood, Ingleton, June 1888, F. Rhodes. Coat Rakes Bridge, Bolland, Aug. 1885! W.D.R. Tadcaster and Wighill, F. G. Binnie, 1880. Boston Spa, April 1893, J. Emmet. Washburndale, July 1885! and Troller's Gill, April 1887! W.D.R. Mason Plain, Grassington, Sept. 1900, F. Rhodes. Copgrove Wood and Lindley Wood, 1885! W.D.R. Eavestone near Ripon, May 1885! J. Ingleby.

York N.W.—Gunnerside Gill, and road-sides, Gunnerside, 1884! W.D.R.

TYNE.

Durham—Ravensworth, shells in Alder Collection, Newcastle Museum. Plentiful, Morden Carrs, 1860, Dr. A. Merle Norman. Spa Wood, Dinsdale, May 1887! Baker Hudson.

Northumberland S.—Stocksfield-on-Tyne, May 1885! H. E. Craven. Not rare, but local, West Woodburn, Sept. 1887! R. Howse.

LAKES.

Westmorland and Furness—Coniston, April 1887! S. C. Cockerell.

Cumberland—Rickerby, near beck (Miss Donald, Cumberland List, 1882, p. 56).

SCOTLAND.

WEST LOWLANDS.

Dumfries—Moffat, Jan. 1891! W. Evans.

Ayr—Gourock Burn, Seamill, Ardneil Bay Portincross, Fairlie, and Knockewart, March 1904, R. Godfrey.

Renfrew—Frequent, Eaglesham (F. G. Binnie, West Scotland List, 1876, p. 41). Frequent, Shielhill Glen and about Greenock (T. Scott, Greenock List, 1886). Near old castle, Inverkip road, Greenock, Aug. 1886! Caldwell, Aug. 1887, J. Steel.

Lanark—Frequent, Possil, Robroyston (F. G. Binnie, West Scotland List, 1876, p. 41). Elvanfoot, Sept. 1900, W. Evans.

EAST LOWLANDS.

Peebles—Slipperfield Loch near West Linton, Aug. 1890! Meldon Hill, July 1890! Standalane Braes! and by Tweed near Peebles, July 1890! W. Evans.

Berwick—Dunglass Dean (G. Johnston, Berwick N.C. Proc., 1838, p. 154). Near Eyemouth, Sept. 1895! W. Evans.

Haddington—Balgone, Jan. 1896! Aberlady, July 1890! Quarry near Gullane! and Luffness marshes! W. Evans.

Linlithgow—Philpstown Loch, Oct. 1890 ! Carribber Glen, Feb. 1898, and Dalmeny, Oct. 1902 ! W. Evans. Mr. R. Godfrey remarks that though not abundant it is almost universal throughout the county, and cites many coast and inland localities, as well as a number in the Avon valley and in the Bo'ness district.

Edinburgh—Bonally, Oct. 1888 ! W.D.R. Hillend Farm, Pentlands, March 1890 ! Balerno, April 1890 ! the Bush, Penicuik, Dec. 1890 ; Arniston, June 1902 ; Duddingston Loch, May 1894, and Vogrie Glen, Feb. 1897 ; Kirknewton ! Roslin ! Dalhousie ! plantation above Dreghorn, March 1890 ! W. Evans.

EAST HIGHLANDS.

Fife and Kinross—Otterston, June 1890 ! Dura Den, July 1890 ! St. Andrews, Aug. 1890 ! Tentsmuir, Aug. 1890 ! Kilconquhar, Sept. 1893, Loch Leven, June 1894 ! and Loch Gelly, May 1895, W. Evans.

Stirling—Frequent, Baldernock and Kilsyth (F. G. Binnie, West Scotland List, 1876, p. 41).

Perth S. and Clackmannan—Port of Menteith, April 1892 ! Dollar, April 1897 ! Wharry Glen near Bridge of Allan, Feb. 1898 ! and Callander, April 1892 ! W. Evans.

Perth Mid—Lawers and Fearnan, Loch Tay side, May 1892 ! W. Evans.

Perth N.—Fenderbridge, Glen Tilt, Sept. 1898, Loch of Clunie, July 1890 ! W. Evans.

Aberdeen S.—Summit of Clunie Pass, altitude 2,100 feet, July 1890 ! W. Evans.

Elgin—Not uncommon in Moray. Abundant on damp warm evenings near Mill of Birnie (Rev. G. Gordon, Zool., 1854, p. 4453). Nairn, Jan. 1887 ! Rev. J. E. Somerville.

Easterness—Kincraig, Oct. 1889 ! W. Evans.

WEST HIGHLANDS.

Main Argyle—Coast south of Dunoon, Aug. 1886 ! W.D.R.

Clyde Isles—Abundant on shores of Loch Greenan, Bute, Aug. 1886 ! W.D.R. Brodick, Isle of Arran, April 1895 ! W. Evans.

Cantire—South of West Loch Tarbert, near head of Loch, April 1886 ! T. Scott.

Ebudes N.—Dunvegan Castle, Skye, W. Thompson (Forbes & Hanley, British Moll., 1853, p. 21).

NORTH HIGHLANDS.

Ross E.—Numerous near Bonar Bridge, Dornoch Frith, Feb. 1887 ! W. Baillie.

Sutherland E.—Near Loch Brora, Oct. 1883 ! Golspie Burn, June 1884 ! South of Little Ferry, Dornoch, Oct. 1884 ! and near the Mound, June 1885 ! W. Baillie.

Sutherland W.—Mouth of Halladaile River, Nov. 1886 ! W. Baillie.

Caithness—Wick (Peach, Caithness List, 1864). Bank of Dunbeath River, May 1884 ! W. Baillie.

NORTH ISLES.

Shetlands—(Heynemann, Jahrb. Deutsch. Mal. Ges., 1885, p. 248).

IRELAND.

This is said by Dr. Scharff to be one of the rarest of the Irish slugs. It was first discovered in Ireland, in April 1884, at Coleraine in Co. Derry, by Mr. L. E. Adams.

ULSTER.

Derry—Coleraine, common, April 1884, L. E. Adams. Culmore near Londonderry, J. N. Milne (R. F. Scharff, Irish Nat., 1892).

Antrim—Colin Glen near Belfast, Oct. 1899 ; in wood, Ballycastle, and Glencorp, March 1900 ; common on marshy ground, shores of Lough Neagh, at Antrim, Aug. 1898 ; and on Ram's Island, Lough Neagh, May 1900 ; also found about Ballycastle, and other localities, but not so common as in County Down, R. Welch. Common in damp parts of wood, Murlough, Sept. 1896 (R. Standen, Irish Nat., Jan. 1897).

Down—Common around flax dam, near Ballynahinch Junction, March 1899 ; common under stones around flax dams, in the White Bog, Killough, Oct. 1898 ; Deer's Meadow, Mourne Mountains, alt. 1,110 feet, Jan. 1898 ; on watercress, below Spring Well, Clonduff Castle, Jan. 1898 ; damp hollow, Newcastle dunes, Aug. 1898 ; common at the roots of rushes, Shaw's Bridge, Belfast, March 1899 ; common on rejectamenta, Ravernet River, April 1899 ; Hillsborough, April 1899 ; marsh near Dundrum, Nov. 1899, R. Welch. Shores of pond, Belvoir Park, May 1898 ; Oakleigh, Ormeau Park, and in marsh, Loughinsland, Feb. 1900, A. W. Stelfox and R. Welch.

Monaghan—Marsh at Lake Glasslough demesne, Oct. 1887, R. Welch.

Donegal—Letterkenny, Nov. 1892, Rev. A. H. Delap.

Fermanagh—Sparingly on shores of lake, Enniskillen, R. Welch.

LEINSTER.

Dublin—Banks of an old fish-pond on Lord Massey's estate, Killakee, Dublin Mountains, Sept. 1890 ; Carrickmines, April 1892, and in orchid houses, Trinity College Botanic Gardens, Jan. 1891, R. F. Scharff. In marsh, Bushey Park, Dublin, Sept. 1903, A. W. Stelfox and R. Welch.

Distribution of *Agriolimax lævis* (Müll.)

In the Counties and Vice-Counties of the British Isles.

ENGLAND AND WALES.

Channel Isles

PENINSULA
1 Cornwall W.
2 Cornwall E.
3 Devon S.
4 Devon N.
5 Somerset S.
6 Somerset N.

CHANNEL
7 Wilts N.
8 Wilts S.
9 Dorset
10 Isle of Wight
11 Hants S.
12 Hants N.
13 Sussex W.
14 Sussex E.

THAMES
15 Kent E.
16 Kent W.
17 Surrey
18 Essex S.
19 Essex N.
20 Herts.
21 Middlesex
22 Berks.
23 Oxford
24 Bucks.

ANGLIA
25 Suffolk E.
26 Suffolk W.
27 Norfolk E.
28 Norfolk W.
29 Cambridge
30 Bedford
31 Hunts.
32 Northampton

SEVERN
33 Gloucester E.
34 Gloucester W.
35 Monmouth
36 Hereford
37 Worcester
38 Warwick
39 Stafford
40 Salop

SOUTH WALES
41 Glamorgan
42 Brecon
43 Radnor
44 Carmarthen
45 Pembroke
46 Cardigan

NORTH WALES
47 Montgomery
48 Merioneth
49 Carnarvon
50 Denbigh
51 Flint
52 Anglesey

TRENT
53 Lincoln S.
54 Lincoln N.
55 Leic. & Rutld.
56 Notts.
57 Derby

MERSEY
58 Cheshire
59 Lancashire S.
60 Lancashire Mid

HUMBER
61 S.E. York
62 N.E. York
63 S.W. York
64 Mid W. York
65 N.W. York

TYNE
66 Durham
67 Northumb. S.
68 Cheviotland

LAKES
69 Westmorland and L. Lancs.
70 Cumberland
71 Isle of Man

SCOTLAND.

W. LOWLANDS
72 Dumfries
73 Kirkcudbright
74 Wigtown
75 Ayr
76 Renfrew
77 Lanark

E. LOWLANDS
78 Peebles
79 Selkirk
80 Roxburgh
81 Berwick
82 Haddington
83 Edinburgh
84 Linlithgow

E. HIGHLANDS
85 Fife & Kinross
86 Stirling
87 Perth S. & Clkn
88 Mid Perth
89 Perth N.
90 Forfar
91 Kincardine
92 Aberdeen S.

E. HIGHLANDS
93 Aberdeen N.
94 Banff
95 Elgin
96 Easterness

W. HIGHLANDS
97 Westerness
98 Main Argyle
99 Dumbarton
100 Clyde Isles
101 Cantire
102 Ebudes S.
103 Ebudes Mid
104 Ebudes N.

N. HIGHLANDS
105 Ross W.
106 Ross E.
107 Sutherland E.
108 Sutherland W.
109 Caithness

NORTH ISLES
110 Hebrides
111 Orkneys
112 Shetlands

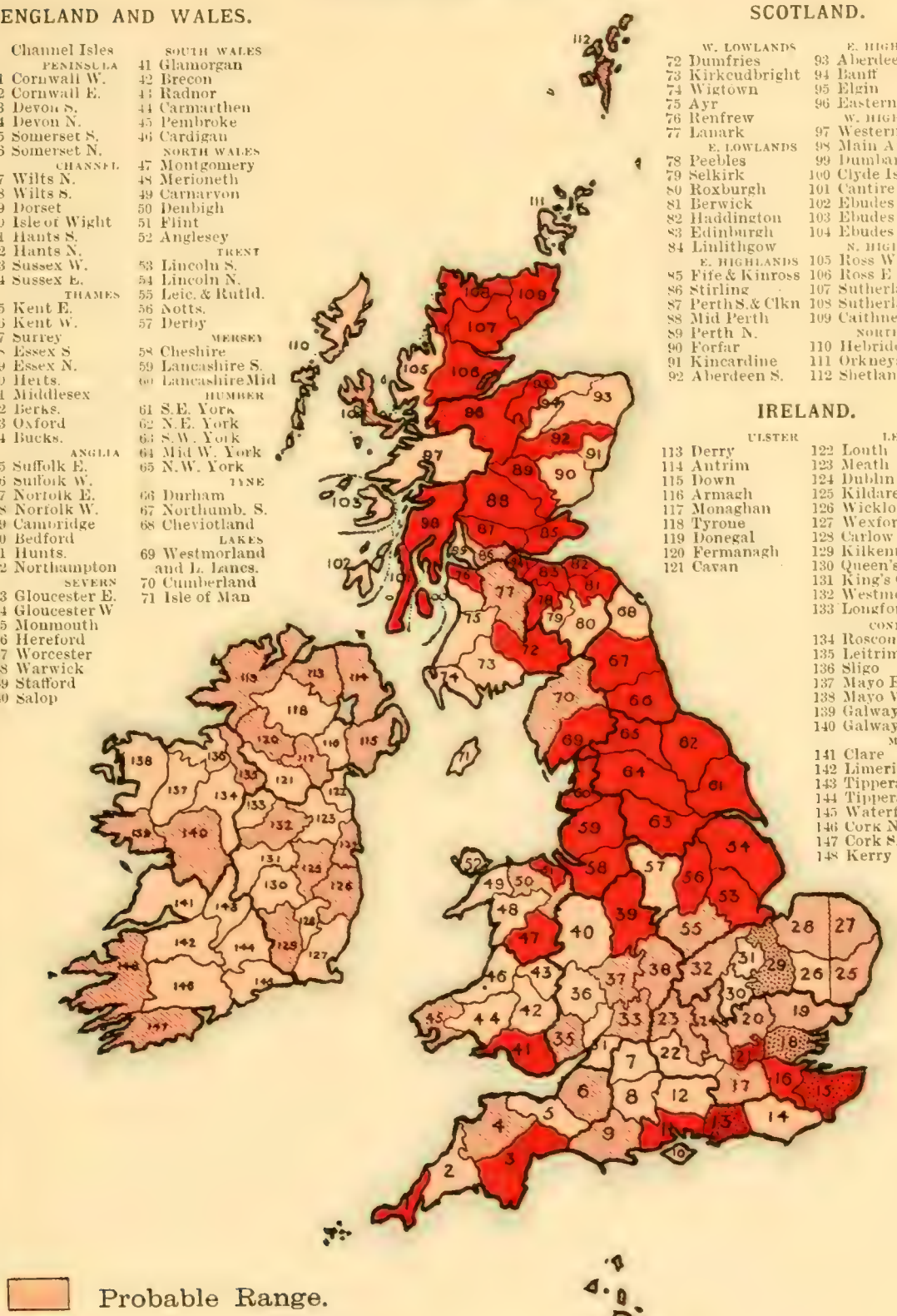
IRELAND.

ULSTER
113 Derry
114 Antrim
115 Down
116 Armagh
117 Monaghan
118 Tyrone
119 Donegal
120 Fermanagh
121 Cavan

LEINSTER
122 Louth
123 Meath
124 Dublin
125 Kildare
126 Wicklow
127 Wexford
128 Carlow
129 Kilkenny
130 Queen's Co.
131 King's Co.
132 Westmeath
133 Longford

CONNAUGHT
134 Roscommon
135 Leitrim
136 Sligo
137 Mayo E.
138 Mayo W.
139 Galway W.
140 Galway E.

MUNSTER
141 Clare
142 Limerick
143 Tipperary N.
144 Tipperary S.
145 Waterford
146 Cork N.
147 Cork S.
148 Kerry



Probable Range.

Recorded Distribution.

Distribution verified by the Authors.

Fossil Distribution.

Kildare—River banks, Monasterevan, Oct. 1899, R. Welch.

Wicklow—Among water-lilies, Woodenbridge, March 1893 (R. F. Scharff, Irish Nat., 1893, p. 149). Greystones (id., 1892).

Kilkenny—In the south of the county, Jan. 1903, P. H. Grierson.

Westmeath—Knockdrin demesne near Mullingar, April 1892, R. F. Scharff.

CONNAUGHT.

Leitrim—Dromahaire, Sept. 1900, R. Welch. Glencar, Sept. 1900, G. W. Chaster and E. Collier.

Galway W.—At roots of rushes in marshy ground, Clonbrock, Hon. R. E. Dillon (R. Welch, Irish Nat., June 1899, p. 143).

Galway E.—About Renvyle and among bogs in the Kylemore district, March 1891, R. F. Scharff. Dernasliggan, April 1897 (R. Welch, Irish Nat., Nov. 1897, p. 304.)

MUNSTER.

Cork S.—Glengariff near Eccles Hotel, May 1891, R. F. Scharff. Blarney Castle and Bantry, Sept. 1898, L. E. Adams.

Kerry—A very dark form in Mucksna Wood; several under logs near Loo Bridge; one at Roughty Bridge; a pale form on the river bank above Galway's Bridge, R. Welch; and Torc Woods, G. W. Chaster, July 1898 (R. Standen, Irish Nat., Sept. 1898). Plentiful on water-lily stems in a swamp near the lower lake in Herbert's Muckross demesne, May 1891, R. F. Scharff. Moderately common, Killarney, Sept. 1898, L. E. Adams. River banks, Kenmare, May 1898, R. Welch.

GERMANY.

According to Herr Clessin *A. lævis* is diffused throughout the country, and it has been recorded from Alsace, Baden, Bavaria, Brandenburg, Coburg, Franconia, Friesland, Hanover, Holstein, Merseburg, Nassau, Pomerania, Saxony, Schleswig, Silesia, West Prussia, and Wurtemburg.

NETHERLANDS.

Belgium—Recorded by Van-den-Broeck as abundant about Jette, Brabant; and as *L. parvulus* from Chaudfontaine, near Liége.

FRANCE.

According to Mabille, this species inhabits nearly the whole of France, but records have only been procurable from

Ain, Aisne, Aquitaine, Ariége, Aube, Basses-Pyrénées, Côte d'Or, Haute Garonne, Haute Savoie, Hérault, Landes, Nièvre, Nord, Oise, Pas-de-Calais, Rhone, Savoie, Seine, Seine-Inférieure, Seine-et-Marne, Somme, Var, Vienne, and the Island of Corsica.

SWITZERLAND.

Herr Clessin states that it is diffused throughout the country.

ITALY.

Hitherto found only in the north of the country in Piedmont and Lombardy. In damp moss, near railway, Menaggio in Lombardy, Sept. 1886, B. Tomlin. Above Viù, Valle di Lanzo, and beneath Crissolo, Piedmont (Less. & Poll., Monog. Limac. Ital., 1882, p. 47).

AUSTRO-HUNGARY.

Herr Clessin describes this species as diffused throughout the whole region. It has been recorded from Moravia, Hungary and Istria, Jarov near Prague in Bohemia, Vienna in Austria, and the Eastern Alps.

SPAIN AND PORTUGAL.

Spain—Near Monastery of Montserrat, Catalonia, May 1881 (P. Fagot, Faun. Mal. Catal., May 1884).

Portugal—*L. lombricoides*, common about Monchique in Algarve; a darker variety inhabits the mountains of Braga in Minho (Morelet, op. cit.).

SCANDINAVIA.

Norway—Only in the south about Christiania and Christiansand (B. Esmark, J. of Conch., Oct. 1886).

Sweden—About Gothenberg (Malm, Limac. Skand., 1868).

Denmark—Around Copenhagen, and on banks of Sorgenfri river, where it was observed by Müller. It occurs, according to Feddersen, throughout the tract of Viborg, in Jutland (Malm, op. cit., p. 82).

RUSSIA.

Only as yet recorded for Moujevo, near Moscow, by Milachevitch, and by A. Luther from Revel in Esthland, and the south part of Finland as far north as 63° north lat.

Agriolimax lævis campestris Binney, Proc. Boston Soc. Nat. Hist., 1841, p. 52.

Limax montanus Ingersoll, Bull. U.S. Geol. Surv. Terr., 1875, p. 391.
Limax castaneus Ingersoll, op. cit.
Limax ingersolli W. G. Binney, Proc. Acad. Nat. Sci. Philad., 1875.
Limax hyperboreus Westerlund, Nachsbl. d. Deutsch. Mal. Ges., 1876, p. 97.

With this geographical race, the late Mr. Amos Binney, the eminent American conchologist, is associated, not only as being the author of the name adopted for the race, but in acknowledgment of the great services he rendered to the advancement of our study.

A Binney

ANIMAL usually of some shade of amber, but occasionally of a blackish hue; without spots or markings; HEAD and OMMATOPHORES smoky; FOOT narrow and whitish.

INTERNALLY, *A. campestris* is, according to Binney, characterized by the jaw possessing recurved and pointed ends, a sharp MEDIAN BEAK, and the centre showing a strong transverse line of reinforcement. The RADULA varies in its formula, 40 + 1 + 40 with eighteen perfect laterals being that of one adult specimen examined. The laterals do not show, as in *A. agrestis*, an inner-side cutting point, but about half the marginals are bifid, the bifurcation of the outer marginals being very obscure.

FIG. 145.—Median, lateral, and marginal teeth of *A. campestris*, highly magnified (after Binney).

The Central and South American forms, described as *Limax stenurus*, *L. meridionalis*, *L. brasiliensis*, and *L. argentinus*, of which no authentic descriptions have been available, are in all probability more correctly referred to this simpler and more primitive form than to the typical *A. lævis*, as though doubtless exhibiting further minor modifications, tending to a nearer approximation with a still more ancient form, yet the intermediate position between the North American *L. campestris* and the South American forms, said to be held by the Mexican *L. stenurus*, tends to confirm the view that the most primitive forms inhabit the more remote regions.

FIG. 146.—Median, lateral, and marginal teeth of *Limax brasiliensis*, × 200 (after Ihering).

FIG. 147. — Reproductive organs of *Limax brasiliensis* (after Ihering).

The *L. queenslandicus*, *A. berenoti*, etc., are also probably more closely allied to this simpler form rather than to the more advanced European race, in which the development of the penial retractor and the distinctly hammer-headed penis-sheath seems to be more especially a characteristic, and may be assumed to be the highest stage of development the species has attained.

The simpler and more primitive forms now inhabiting the New World, the inclement regions of Siberia, etc., possess, according to Simroth, a short stimulating organ and an elongate rather than a hammer-shaped penis-sheath, resembling the immature form figured by him. It would thus seem that in Europe *A. lævis* is somewhat variable in the development of its genitalia, and that the uncommon or immature form in Europe is the prevalent one in the New World.

Quebec—*Limax campestris*, Gaspé, May 1892 (A. W. Hanham, Nautilus, Oct. 1893, p. 65). Rather local about Quebec (id., Nautilus, Jan. 1897).

Ontario—*L. campestris*, near McKay's Bay, New Edinburgh; and common about Ottawa in moist places everywhere except on sandy soil (F. R. Latchford, Trans. Ottawa Field Nat. Club, 1886).

Manitoba—*L. campestris*, occasionally at Winnipeg (A. W. Hanham, Nautilus, May 1899, p. 3).

Maine—*L. campestris*, common in woods (E. S. Morse, Pulm. of Maine, 1864, p. 7).

Massachusetts—*L. campestris*, Westport, under rocks and fallen trees, in old pastures (J. H. Thomson, J. of Conch., Oct. 1885).

Rhode Island—*L. campestris*, under rocks and fallen trees in old pastures (J. H. Thomson, J. of Conch., Oct. 1885).

New Jersey—*L. campestris*, Redbank, H. Prime, Oct. 1885. Cape May (H. A. Pilsbry, Nautilus, Nov. 1890, p. 74). Burlington, A. Ten Eyck Lansing (W. G. Binney, Terr. Moll., 1878, vol. 5, p. 149).

New York—*L. campestris*, Plattsburgh, widely distributed, G. H. Hudson, Oct. 1885. General in Onondago Co., W. M. Beauchamp, Oct. 1885. Quite common in Cayuga Lake Valley (N. Banks, Nautilus, April 1892). East Rochester, Monroe Co. (J. Walton, The Museum, July 1898, p. 133). Vicinity of Owasco Lake (F. C. Baker, Nautilus, Sept. 1899, p. 58).

Pennsylvania—*L. campestris*, Westchester, Chester Co., W. D. Hartmann, 1885. Common in most suitable localities around Philadelphia (M. Schick, Nautilus, April 1895, p. 135).

Ohio—*L. campestris*, Cincinnati (Harper & Wetherby's Catalogue, Feb. 1876).

Michigan—*L. campestris*, generally distributed (B. Walker, Moll. Michigan, p. 21, 1899).

Indiana—*L. campestris*, common in Franklin Co., Moore & Butler, 1885.

Iowa—*L. campestris*, abundant and widely distributed, Desmoines, Iowa City, and Bonaparte, and doubtless throughout the state (C. R. Keyes, Bull. Essex Inst., June 1888, p. 65).

Nebraska—*L. campestris*, only in the eastern counties of the state (Aughey, Bull. Surv. Terr., 1877, p. 698).

North Carolina—*L. campestris*, Roan Mountains (Pilsbry & Walker, Proc. Acad. Nat. Sci. Philad, 1897, p. 489).

South Carolina—Aiken (W. G. Binney, Terr. Moll., 1878, vol. 5, p. 149).

Missouri—Sedalia, Pettis Co., in plenty in open woods and in pastures far away from timber, F. A. Sampson, Oct. 1885.

Kansas—*L. campestris*, Sedgwick Co. (F. J. Ford, Nautilus, Jan. 1890, p. 106).

Arkansas—*L. campestris*, Carroll; Sebastian; Pulaski; Perry; Nevada; and Franklin; the specimens from Franklin Co. are nearly two inches in length (F. A. Sampson, Report Geol. Survey Arkansas, 1891).

New Mexico—*Limax campestris*, Roswell, Pecos Valley (T. D. A. Cockerell, Nautilus, July 1896, p. 35). Mescalero Indian Reservation, in the Sacramento Mountains, above the Agency (id., J. of Mal., May 1897, p. 4).

NEOTROPICAL REGION.

Bermuda—*A. lævis* sens. lat., specimens in the British Museum, collected by the Challenger Expedition (T. D. A. Cockerell, J. of Mal., May 1897, p. 3).

Jamaica—*A. lævis* sens. lat., common at Moneague, Jan. 1892; also found at Cinchona by Mr. Fawcett and Mr. W. Cradwick (T. D. A. Cockerell, J. of Mal., May 1897, p. 3).

Mexico—*L. stenurus* (Heynemann, Jahrb. Deutsch. Mal. Ges. 1885, p. 274).

Brazil—*L. brasiliensis*, Rio Grande de Sul (Ihering, op. cit.).

Argentine—*Limax meridionalis*, Cordoba (Ihering, op. cit.); *L. argentinus*, Strobel, Rio Negro, Patagonia, 1879 (Roca, J. de Conch., 1883, p. 272).

ETHIOPIAN REGION.

South Africa—(R. Sturany, J. of Mal., May 1899, p. 43).

Madagascar—(Simroth, Portug.-Azor. Fauna, 1891).

AUSTRALASIAN REGION.

Sandwich Isles—Mr. Collinge, who has examined a collection from these islands, refers the individuals inhabiting the more lofty regions to his *A. bevenoti*, citing as localities Honolulu, at an altitude of 2,000 feet; Kauai, at 4,000 feet; and Haleakala, at 5,000 feet; while *A. lævis* is said to be found on the lower ground at an altitude of 2,000 feet at Kauai. Specimens which cannot be referred with certainty to either form were found at Haleakala, 5,000 feet altitude; on mountains near Honolulu, at 2,000 feet altitude; and between Olaa and Kilauea, at altitudes between 2,000 and 4,000 feet (Proc. Mal. Soc., 1897, p. 295).

Cook's Islands—*Limax rarotonganus*, Rarotonga (Heynemann, op. cit.).

New South Wales—*Agriolimax rarotonganus*, Sydney (Heynemann, Jahrb. Deutsch. Mal. Ges., 1885, p. 303). Parramatta, probably the *Limax olivaceus* of Gould (C. T. Musson, Proc. Linn. Soc. N.S.W., 1890, p. 885).

Queensland—*L. queenslandicus*, Brisbane (C. T. Musson, op. cit.). *A. rarotonganus*, Burnet river and Port Dennison (Heynemann, op. cit.).

Var. **occidentalis** Cooper, Proc. Acad. Nat. Sci. Philad., 1872, p. 146, pl. 3.

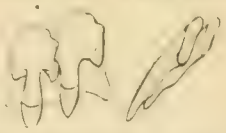


Fig. 148.—Median, lateral, and marginal teeth of *A. campestris* v. *occidentalis*, highly magnified (after Binney).

The ANIMAL does not differ externally from the ordinary *campestris*, except being said by Dr. Cooper to be rather more robust than the eastern form; he also remarks that it is paler in colour when it first emerges from its retreat in the dry season. INTERNALLY the specimen examined by Binney showed a RADULA with a formula 35+1+35, with thirteen laterals, the inner and outer lateral teeth occasionally showing a side spur, and approaching in this respect the var. *montanus* rather than the typical *campestris*.

California—*Agriolimax campestris* var. *occidentalis*, numerous about San Francisco; Santa Cruz; Clear Lake, and at Alta, Placer Co., 3,625 feet elevation on the west slope of the Sierra Nevada; also at Truckee, Nevada Co., 5,866 feet high on the east slope. It has also been found on the Coast Mountains, and along the coast almost everywhere, from 39° north lat., to San Juan, near lat. 33°, J. G. Cooper, Oct. 1885. *A. campestris* var., Lake Merced, San Francisco Co., Mr. Raymond (T. D. A. Cockerell, J. of Conch., Oct. 1891).

Var. **montanus** Ingersoll, Bull. U.S. Geol. Survey, Terr., 1875, p. 394.

Agriolimax montanus α *typicus* T. D. A. Cockerell, J. of Conch., Oct. 1888.
Limax ingersolli W. G. Binney, Proc. Acad. Nat. Sci. Philad., 1875.

ANIMAL bluish-grey in colour, stout in form, with a blunt posterior extremity, and exceeding one inch in length.

INTERNALLY, the RADULA shows a formula of 50+1+50, with sixteen perfect laterals.

Prof. Cockerell has pointed out that Ingersoll's description was probably made from spirit specimens, and that the bluish-grey colour was due in great part to an exudation of slime, such as is often observed in alcoholic specimens; *A. montanus* α *typicus* Ckll., which is described as "rather pale brown, foot-sole pale," in all probability represents Ingersoll's species when living.

Fig. 149.—Reproductive system of *L. montanus* (after Binney).

Montana—*L. montanus*, one at Missoula, June 1897 (M. J. Elrod, Nautilus, March 1902, p. 129).

Utah—*L. montanus* (H. A. Pilsbry, Proc. Acad. Nat. Sci. Philad., 1889, p. 196).

Colorado—*A. campestris* var. *montana*, Pueblo Co., and Rio Grande Co. (T. D. A. Cockerell, Moll. Colorado, J. of Conch., Jan. 1889). Hot sulphur springs, Grand Co., Mr. Ingersoll; Custer Co.; Chaffee Co.; Canon City, Fremont Co.; Summit Co.; Eagle Co.; Mesa Co.; and Gunnison Co. (id., Naut., Jan. 1890, p. 100).

Var. **castanea** Ingersoll, Bull. U.S. Geol. Survey Terr., 1875, p. 394.

Limax castaneus Ingersoll, op. cit.

ANIMAL small and slender, colour lively brown, with darker spot on the SHIELD; HEAD and OMMATOPHORES black; FOOT-SOLE white. Length less than one inch.

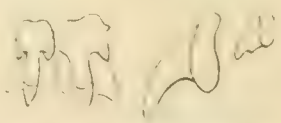


Fig. 150.—Median, lateral, and marginal teeth of *L. castaneus*, highly magnified (after Binney).

Binney describes the RADULA as similar in character to that of *L. montanus*, the formula being 34+1+34, with twelve perfect laterals.

According to Prof. Cockerell, the var. *castanea* was described from a young example, the black head and tentacles being a feature imparted to alcoholic specimens and not existing in living animals.

Colorado—*A. campestris* var. *castanea*, Blue River Valley, Mr. Ingersoll (T. D. A. Cockerell, Nautilus, Jan. 1890, p. 100).

Var. **intermedius** Cockerell, J. of Conch., Oct. 1888, p. 359.

ANIMAL dark-brown, foot-sole grey.

Colorado—*A. campestris* var. *intermedia*, Wet Mountain Valley, Custer Co.; Canon City, Fremont Co.; Wales Canon, Pueblo Co.; Saguache Co.; Summit Co.; Mesa Co.; and Delta Co. (T. D. A. Cockerell, Nautilus, Jan. 1890, p. 100).

Var. **tristis** Cockerell, op. cit.

ANIMAL very dark-brown or brown-black. This form, which in its colouring is nearly allied to var. *hyperborea*, is found chiefly at high elevations in the mountains.

The effect of living under the extreme conditions found at high altitudes upon the pigmentation of this species, is shown by the darkest forms being most prevalent in the highest elevated localities, and is corroborated by the dark colour of the var. *hyperborea*, found on the Arctic shores of Siberia and North America.

Colorado—*A. campestris* var. *tristis*, Lake Co.; Summit Co.; and Delta Co. (T. D. A. Cockerell, Nautilus, Jan. 1890, p. 100).

Var. **hyperborea** Westl., Nachricht. Deutsch. Mal. Ges., Sept. 1876, p. 97.

Limax hyperboreus Westerlund, op. cit.

BODY firm, black above, sides paler, pale beneath, back convexly rounded, narrowing behind, tail short, compressed and subcarinate above; SHIELD broadly rounded behind, thicker and much wider in front, inner margin reflexed. Long., 10 mill.; lat., 3 mill.

FIG. 151.—Median, lateral, and marginal teeth of *Limax hyperboreus*, highly magnified (after Binney).

INTERNALLY, it is described by Binney as possessing a smooth arched jaw, with a blunt median projection; RADULA with a formula of 42 - 1 - 42 teeth, the centrals tricuspid; laterals twelve in number and bicuspid; marginals about thirty, simply aculeate or with a bifurcation or side-spur.

Siberia—Nordenskiöld and Stuxberg found it at Goroschinskoj, 66° 17′ north lat., on Sept. 10, 1875; and on the island Sopotschnoj, in the Jenissei river, 70° 5′, on Aug. 29, 1875 (Westerlund, op. cit.). Dr. Theel collected it at Tolstoinos, Aug. 1876, and according to Westerlund it is recorded as *Arion ater* by Gerstfeldt from Eastern Siberia (id., Siber. Land Sotvatt. Moll., pp. 102 and 110). Dr. Dall also records that it was found by Stejneger and by the Vega Expedition on the Commander Islands. It is said to be found also in Kamschatka (Proc. U.S. Nat. Mus., 1886, p. 217). Tschukschis Peninsula (Simroth, Portug.-Azor. Fauna, 1891).

Nearctic Region—Found throughout the Arctic shores of North America, and on the Aleutian and Behring Islands (Dall, op. cit.).

Labrador—Not uncommon on May 16th, 1883, and July 23rd, 1884, under stones in moist places in willow thickets, etc., about Fort Chimo, Ungava Bay (Dall, op. cit., p. 203).

United States—Quincey, California, 1889, H. F. Wickham (T. D. A. Cockerell, J. of Mal., 1897, p. 4).

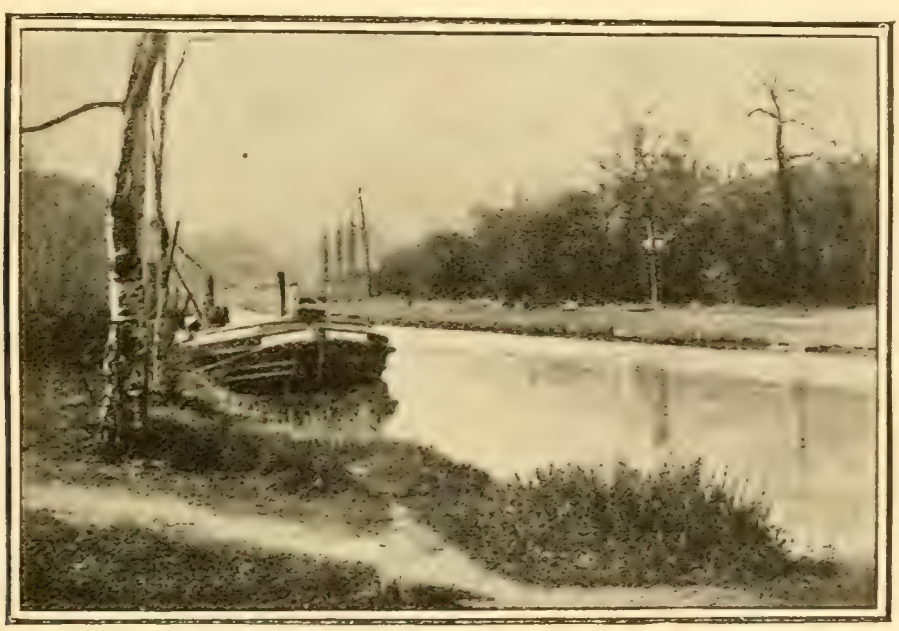
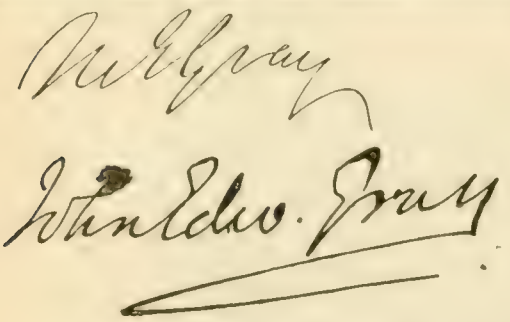


FIG. 152.—Banks of Leeds and Liverpool Canal, near Kirkstall, a favourite locality for *Agriolimax lævis* (photo. by Mr. R. Mackay).

Genus *MILAX* Gray.

(Amalia, Moquin-Tandon ; Lallemantia, Mabille).



The genus *Milax* (*Milax*, a word formed by a transliteration of *Limax*) was instituted by Dr. Gray in the Cat. Pulmon. Brit. Mus., published on May 1st, 1855, but in which the preface was dated March 29th.

The term *Milax* antedates Moquin-Tandon's name of *Amalia*, which was published in his "Hist. Moll. Terr. et Fluv. France," ii., p. 17, on Sept. 10th, 1855. The preface to that work, though dated March 15th, was really issued with the third part on Aug. 1st, while the fourth part, in which the term *Amalia* was first instituted, did not appear until Sept. 10th, 1855, the misleading date of the preface to the work having led to the wrongful use of *Amalia*.

With this genus Dr. J. E. and Mrs. Gray have been associated in recognition of the institution of the present group and of the impetus their conchological works have had upon the popularization of conchology generally.

In this country we have but two species, which, although placed by Pollonera in separate sub-genera, *Tandonia* and *Pirainea*, do not show, at least in British specimens, the differential characters he has assigned to them, but are, in fact, somewhat closely allied in structure and aspect, but according to Dr. Simroth, within certain limits, no genus is so unstable in its organization as is *Milax*, a group which, in his opinion, is only at the outset of its course, in the formation of species for the future.

Generic Characteristics.—EXTERNALLY, in *Milax* the body is longitudinally grooved, and acutely keeled the whole length of the back. The MANTLE is shagreened or delicately wrinkled, bears a bluntly lenticular or horse-shoe shaped groove, more or less completely circumscribing a somewhat prominent postero-central part which simulates a smaller, superposed mantle: the RESPIRATORY ORIFICE is placed on the right side behind the centre of the mantle, and is not cut by the anal channel,

which is in advance; the REPRODUCTIVE ORIFICE is situate mid-way between the base of the right ommatophore and the respiratory orifice. The ORGAN OF SEMPER is externally perceptible as crenulations or puckerings of the upper lip, which presents a row of eight or more rounded papillæ.

INTERNALLY, the viscera show a strong spiral twist[1] in a sinistral direction, the amount of torsion corresponding somewhat to that of a dextrally coiled *Buliminus*. The REPRODUCTIVE ORGANS do not loop the retractor of the right tentacle, and possess a very remarkable series of accessory glands adherent to the base of the oviduct and atrium, into which they debouch by numerous slender ducts; there is no flagellum, but a well-marked epiphallus, within which a spermatophore is developed, and which is basally separated from the penis by a well-marked sphincter muscle. The PENIS-RETRACTOR arises from the dorsal skin on the right-side, just below the root of the cephalic retractor, and is attached to the epiphallus. The SARCOBELUM, or excitatory organ, though present in our British species, is not an invariable character in all the species of the genus; the *Milax carinatus* of southern Europe, which in other respects is so closely related to our *Milax sowerbii*, is said by Lessona & Pollonera to be destitute of an excitatory organ, though Dr. Simroth found it present in a Florentine specimen forwarded by Signor Lessona. The KIDNEY is somewhat oval in shape, and differs from that of *Limax* in having a linguiform prolongation, doubled back under the organ and protruding behind on the right side. The SUPRA-PEDAL GLAND lies free in the body cavity, and is only about one-third the total length of the body.

The CEPHALIC RETRACTORS comprise the pharyngeal and tentacular muscles, which are usually separate nearly or quite to their roots, though their points of origin are always closely contiguous; they arise from the dorsum, beneath the floor of the shell sac, to which they are firmly attached, exactly at or near to the point where the shell is adherent by its apex to the floor of the pouch.

The FOOT-SOLE is distinctly longitudinally tripartite, the broad mid-area being bounded by a well-marked groove at each side, and the wrinklings formed during the contraction of the sole, unlike those of the true *Limaces* and *Agriolimaces*, which are simply transverse, show in *Milax* a striking chevron-like character in the median-line, an arrangement said to tally accurately with the disposition of the lateral branches of the sympathetic mesh of the pedal nerves.

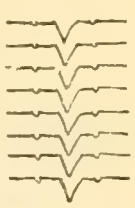


FIG. 151.—Diagram of the foot-sole of *Milax*, showing the chevron-shaped transverse wrinklings of the median-area.

The law of colouring is similar to that pertaining to *A. agrestis*; the animals darken with age, the darker mantle-markings being assumed to be ancestral traits not yet obliterated, and formed by the approximation and fusion of the isolated spots of young animals. The primitive colouring of the species of this group is supposed to be simple, and just as *A. agrestis* shows unicolorous dark or slate-blue varieties on the Mediterranean shores, *Milax* has developed a preponderance of dark unicolored species or varieties in similar situations.

In the eastern Mediterranean region, *Milax* is separable into the species furnished with a prominent dorsal keel and those in which the keel is confined to the caudal end of the body; the latter, which form the section

1 Monog. i., p. 282, f. 562.

Subamalia of Pollonera and the *Malinastrum* of Bourguignat, are confined to the mountains and are probably the more ancient forms. The strongly carinate species found in the Crimea, Greece, Transylvania, Austria, Germany, and Italy, which have been classified under *Tandonia* and *Pirainea* of Lessona & Pollonera, are mostly of a reddish or brownish tint, but more westwardly the reddish ground gradually disappears, the animals becoming ochreous or black.

The species of *Milax* are slow and sluggish in movement, possess a thick skin, and secrete a tough and viscid mucus. According to Simroth, they are essentially carnivorous and predaceous, though occasionally devouring vegetable food. The duration of life in the *Milaces* is uncertain, but Simroth thinks it extends over several years.

Conjugation in *Milax* is not restricted to any particular season, but in mild weather may take place at any period of the year, the act itself being very prolonged; Mr. Kew has observed it on one occasion to continue for a space of seventeen hours, this lengthy ceremony being probably necessitated by the time requisite for the formation and transference of the elaborate spermatophore.

Fossil.—A *Milax* (*M. gracilior* Sandberger) is recorded from the Upper Miocene beds at Biberach, Wurtemburg, by Sandberger, but in this country it has not been reported from any deposits lower than the Pleistocene.

Geographical Distribution.—This genus, according to Simroth, has not naturally a wide distribution, as, excepting its occurrence in the extreme points of Australia, New Zealand, South Africa, California, and several oceanic islands, in all of which it may have been artificially introduced, its range is, as far as at present known, confined chiefly to the Mediterranean and European region.

Fig. 155.—Obverse and reverse of medal struck in 1863 in honour of Dr. and Mrs. Gray.

Milax gagates (Draparnaud).

1801 *Limax* **gagates** Draparnaud, Tabl. Moll., p. 100, no. 1.
1805 — — Draparnaud, Hist. Nat., p. 122, pl. 9, f. 1, 2.
1824 — *maurus* Quoy & Gaimard, Voy. Uranie, p. 426.
1855 — (*Amalia*) *gagates* Moquin-Tandon, Hist. Moll., vol. 2, p. 19, pl. 2, f. 1-3.
1872 — *hewstoni* Cooper, Proc. Acad. Nat. Sci. Philad., p. 147, pl. 3.
1855 **Milax** *gagates* Gray, Catal. Pulm., p. 174.
1880 — *tasmanicus* Tate, Proc. Roy. Soc. Tasmania, p. 16.
1876 *Amalia marginata* mut. *gagates* Pini, Bull. Soc. Mal. Ital., vol. 2, p. 107.
1897 — *babori* Collinge, Proc. Mal. Soc., p. 294.

R. D. Darbishire

HISTORY.—*Milax gagates* (*gagates*, jet), is one of our more uncommon slugs, and though typically of jet black hue, is in this country more frequently found of a pale plumbeous or brownish tint.

This species was first described by Draparnaud in 1801, and was first discovered in Great Britain by Mr. R. D. Darbishire, B.A., F.G.S., of Victoria Park, Manchester, who in September 1851, found a characteristic specimen at the foot of a hawthorn hedge, on the Isle of Portland, which was identified by Prof. Forbes.

Mr. E. A. Smith, in the Proc. Zool. Soc., 1884, p. 276, suggests the probability that the *L. capensis* Krauss may prove to be referable to our species; and Mr. C. T. Musson makes a similar suggestion in reference to the *L. pectinatus* of Selenka.

Prof. R. Tate has described (Proc. Roy. Soc. Tasmania, 1880, p. 16) a *Milax nigricolus*, which inhabits the gullies of the Adelaide hills, and is widely dispersed over the Adelaide plain generally. Though presented as a new and probably indigenous species, the author suggests that it may be identical with *Milax gagates*.

Dr. Simroth considers *Amalia doderleini*, *A. sicula*, and *A. insularis* as all synonymous with the present species, and agrees with Heynemann in similarly regarding *Limax scaptobius* of Bourguignat, but as there appears to be some conflict of opinion on the subject, their views are simply recorded here.

Diagnosis.—EXTERNALLY, *Milax gagates* is known from its congener by its more uniform colouring; by the keel being usually of the same or of a darker tint than the body, and by its greater prominence at the caudal extremity; the parallel longitudinal groovings of the body are also quite unpigmented, and the intervals between the groovings smooth or delicately granulate.

INTERNALLY, it is sharply differentiated by the globose spermatheca and the protuberant atrium or vestibule.

Description.—ANIMAL comparatively slender, and usually 50 mill. or more in length when extended; typically of an almost uniform black above, but in this country more frequently of a drab, lavender or plumbeous-grey; DORSAL-KEEL very prominent and sharp, especially at the caudal end, where it is abruptly angulated; it extends the whole length of the back, strongly indenting the hind margin of the shield when the animal is at rest, and is usually of the same or a darker colour than the body; the BODY is longitudinally and regularly sulcate, the intervening spaces being only slightly granulate; SHIELD or mantle ample, truncately rounded behind, finely wrinkled and bearing a bluntly lenticular or horse-shoe shaped unpigmented sulcus, which circumscribes a somewhat protuberant and slightly darker central area beneath which the vestigial shell is lodged; FOOT-SOLE pale, distinctly tripartite, the mid area much broader than the side-areas, and separated by a deep furrow; FRINGE same colour as side of sole, without lineoles, rather thick and rounded at the front, defined from the sides by a deep channel; TENTACLES moderately long and granulose; lower tentacles short. MUCUS thick, glutinous, and colourless when in health, but when irritated or scalded tinged with pale yellow, and slightly milky from the presence of innumerable minute granules of carbonate of lime.

SHELL more or less elongately oval in shape, glistening white in colour, and somewhat convexly rounded on the upper side; APEX or nucleus subterminal and almost median, encircled with strong and regular concentric lines of growth; under-side flat, or even somewhat convex owing to the presence of an almost flat calcareous plate, the shell thus often presenting a double appearance when viewed laterally, simulating two shells placed one upon another.

FIG. 157.—Internal shell of *M. gagates* × 4. (Christchurch, Hants, Mr. C. Ashford).

Length, 4½ mill.; breadth, 3 mill.

INTERNALLY, the NERVOUS MATTER is closely aggregated round the throat, the dark-grey and triangular cerebral ganglia being connected by a short broad dark-grey commissure; the buccal ganglia are whitish, a little more than their own diameter apart, and joined to the cerebral ganglia by dark-grey connectives; the SUPRA-PEDAL GLAND is free, and only half the length of the body in adults, and even less in immature individuals. The LIVER is chestnut-coloured, the right lobe forming the posterior end of the visceral mass, the left is directed forwards to the KIDNEY, which has a long tongue-shaped prolongation beyond the right margin of the organ.

FIG. 158.—Nerve centres of *Milax gagates*, showing otocysts (greatly enlarged).

The ALIMENTARY CANAL shows a broad and brown ŒSOPHAGUS; an ample brown CROP with white SALIVARY GLANDS adherent to its walls; the intestinal coils are triodromous, but owing to the strong spiral twisting to which the whole of the viscera have been subjected they appear much more complex; the second intestinal tract extends beyond the termination of the stomach, and turns in the caudal lobe of the liver, the rectum passing to the anal opening at the right side of the body without looping the retractor.

The REPRODUCTIVE SYSTEM opens externally about half-way between the right ommatophore and the respiratory orifice; the OVOTESTIS is oval and whitish, with large acini; the DUCT becomes ample and tortuous as it nears the albumen gland, where there is a well-defined VESICULA SEMINALIS; the ALBUMEN GLAND is pale ochreous, gelatinous and semi-transparent; the SPERM-DUCT is of an opaque milk-white colour and not well developed; the OVIDUCT is semi-transparent, with a tinge of blue; the FREE-OVIDUCT narrow and cylindrical; the VAS DEFERENS short, entering the epiphallus terminally; the PENIS-SHEATH is small and insignificant, with longitudinal ribbing, terminated distally by a large and well-marked bluish-white EPIPHALLUS, which is annularly ribbed internally, the ribs being visible externally as opaque-white specks; the basal limits are denoted exteriorly by a distinct sphincter, and interiorly by two annular series of projecting papillæ; the penis-sheath enters the bulbous and bulging ATRIUM at the side within the protuberant part of which, opposite the penial opening, there is a smooth and ploughshare-shaped excitatory organ, or SARCOBELUM; the PENIAL-RETRACTOR, which is quite slender,

FIG. 159.—Sarcobelum of *Milax gagates* (greatly enlarged).

arises from the convex side of the epiphallus, and is fixed to the oviduct; SPERMATHECA large and globose when fully distended, connected laterally to the oviduct by

FIG. 160. FIG. 161. FIG. 162.

FIG. 160.—Alimentary tract of *Milax gagates*, showing the buccal bulb and nerve-ring, × 2.

FIG. 161.—Sexual organs of *M. gagates*, × 3, the accessory glands turned aside to show the protuberant atrium. *alb.gl.* albumen gland; *ot.* ovotestis; *sp.* spermatheca; *p.s.* penis-sheath; *ep.* epiphallus; *r.* retractor; *gl.* accessory glands.

FIG. 162.—Cephalic retractors of *M. gagates*, × 8.

tissue and more firmly at the apex; its short, stout stem opens into the free-oviduct, at whose junction with the atrium are large foliated accessory glands with long ducts, resembling salivary glands in their whiteness and lobular form.

The CEPHALIC RETRACTOR is somewhat variable in its development; it usually arises from the dorsum from a single root, and is often attached to, or beneath, the apex of the shell, travelling a short distance as a single band; occasionally the PHARYNGEAL and TENTACULAR portions may arise independently, each from its own base or root, but these are always closely contiguous; the pharyngeal muscle is invariably deeply cleft, and the retractor of the right tentacle does not separate the male and female organs, as in the typical *Limaces*.

MANDIBLE or jaw moderately arcuate, thick, and of a deepish horn colour, with very fine striæ on the anterior surface; ends bluntly rounded; median beak or rostrum not prominent and very obtuse.

FIG. 163.—Mandible or jaw of *Milax gagates*, × 12.

The LINGUAL MEMBRANE is of the usual shape, and in a Christchurch specimen displays series of closely-set teeth, projecting forward in the centre and sloping backward towards the margins; the median series of teeth are slightly smaller than the neighbouring laterals, and are distinctly tricuspid with the mesocone strong and

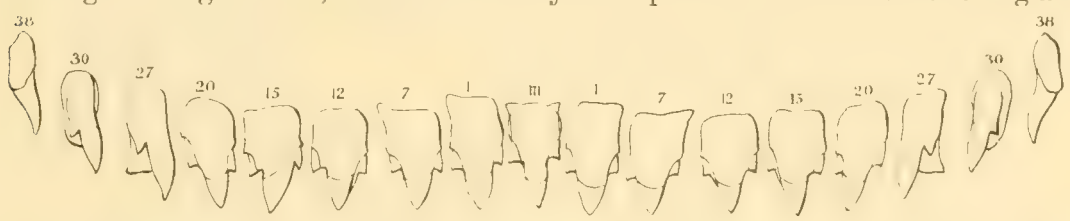


FIG. 164.—Representative denticles from a transverse row of the lingual teeth of *M. gagates*, × 180. The animal collected at Christchurch by Mr. C. Ashford, and the palate prepared by Mr. J. W. Neville.

well developed; the laterals are also clearly tricuspid, the mesocone gradually increasing in strength and importance; the marginals are chiefly bicuspid, showing a strong mesocone and distinct ectocone, the endocone so well developed on the lateral teeth having become gradually lost, while the extreme marginals are simply aculeate.

The formula of a Christchurch specimen is

$$\frac{16}{2\cdot1}+\frac{24}{3}+\frac{1}{3}+\frac{24}{3}+\frac{16}{2\cdot1}\times 98 = 7{,}938.$$

Reproduction and Development.—The congress of this species may take place at any period of the year, during mild weather, and as is indicated by the presence of a well-developed excitatory organ within the

bulging atrium, is probably preceded by mutual exchange of blandishments and stimulatory actions, the operation itself occupying many hours, this great length of time being necessary to allow time for the secretion of the spermatophores and for their mutual transference.

The eggs are slightly oval in shape, transparent, delicate, and thin shelled, and measure 2 mill. in length and 1½ mill. in width. They are agglutinated together by a colourless mucosity and deposited in moist spots in the soil, or beneath some protection, and hatch in less than a month; the young, according to Prof. Krause, when excluded are white, with a semi-circular black band on the mantle, and the margin of the pallial gutter filled with pigment; they may afterwards become tinted with grey, especially towards the end of the keel, following this by assuming a reddish colour, with a greenish tint at the sides, and although all do not follow in the same line of colour development, yet as they increase in size they gradually assume the adult coloration.

Food and Habits.—*Milax gagates* is a shy and retiring species, and of nocturnal habits; though more active than its congener, it is also addicted to a somewhat subterranean mode of life, but may be met with crawling on the earth during the day after long-continued or heavy rain.

Though essentially a ground slug, frequenting heaps of decaying vegetable matter, the foot of old walls, hedgerows, and amidst thick herbage or tufted plants, in gardens, etc., yet it has at times been noticed crawling up the trunks of apple and lime trees, and upon old walls.

It can spin mucous-threads easily and well, and quickly avails itself of this method of reaching the ground when placed in distasteful positions.

When at rest it assumes, according to Dr. Norman, a more rounded form than any other British *Limax*, so contracting itself that its height is but little exceeded by its length.

Though perhaps chiefly vegetarian, and very destructive to young plants and underground roots and bulbs, yet it is also not only carnivorous but predaceous, eagerly destroying and devouring *Helices* and slugs, and even sickly or weaker individuals of its own kind.

In captivity it is very omnivorous, as out of 195 different kinds of food offered to it by Mr. Gain it ate more or less readily 173, though only devouring with eagerness potato tubers and the root of carrot.

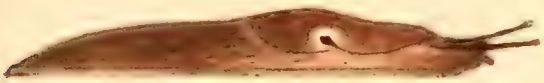
Fossil.—It has been reported from the Pleistocene deposits near Portland Bill, Dorset, on the authority of Prof. Prestwich (J. C. Mansel-Pleydell, Moll. Dorset, 1898).

Variation.—The external variation in *Milax gagates* would appear to be more largely geographical and less sporadic than in many species, although M. Bourguignat describes it as a variable species, sometimes greenish or yellowish or even bluish in colour.

British specimens are generally smaller, smoother, more pellucid, and paler than those inhabiting more southern and warmer districts. The Mediterranean forms are often large, black, more opaque, and more rugose than our British specimens, and the black pigment tends to invade the side-areas of the sole; this major form has been especially noticed in Algeria, and has been regarded as a sub-species by Prof. Cockerell, under the name of *Amalia mediterranea*. In Sicily, this pigmentation of the sole is not so far advanced, the side-areas being still grey; this transitional stage has been distinguished as forma *similis*, while closely-allied individuals from Morocco have been differentiated as forma *atlantica* Ckll.

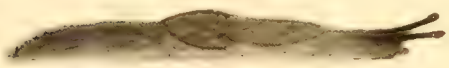
AGRIOLIMAX AND *MILAX.*

1. *Agriolimax agrestis var. pallida, p.* 112.
Horsforth, Yorks.

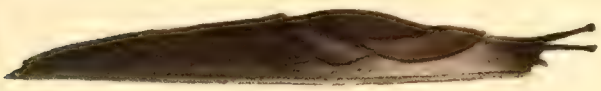


2. *Agriolimax agrestis var. brunnea, p.* 114.
Bonar Bridge, East Ross, W. Baillie.

5. *Agriolimax lævis, p.* 122.
Newlay, Yorks.

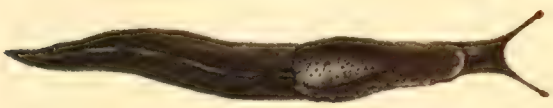


6. *Agriolimax lævis var. grisea, p* 126.
Downpatrick, Down, R. Welch.



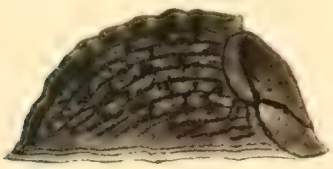
9. *Milax gagates, p.* 140.
Sale, Cheshire, C. Oldham.

10. *Milax gagates var. bicolor, p.* 146.
Guernsey, B. Tomlin.

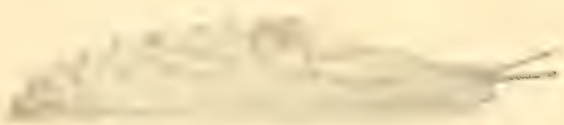


11. *Milax gagates var. benoiti, p.* 146.
Sicily.

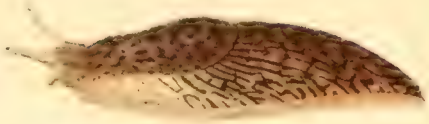
15. *Milax sowerbii, p.* 151.
Woodbridge, E. Suffolk, Rev. S. S. Pearce.



16. *Milax sowerbii var. nigrescens, p.* 151.
Aberayron, Cardigan, W. Whitwell.



17. *Milax sowerbii, var. alba, p.* 155.
Tenby, Pembroke, A. G. Stubbs.



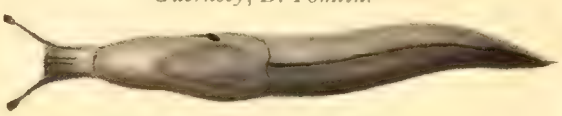
3. *Agriolimax agrestis var. reticulata, p.* 115.
(after Férussac, pl. v. f. 7).

4. *Agriolimax agrestis subvar. lilacina, p.* 113.
Stroud, Gloucestershire, E. J. Elliott

7. *Agriolimax lævis subvar. maculata, p.* 126.
Barnes, Surrey, T. D. A. Cockerell.

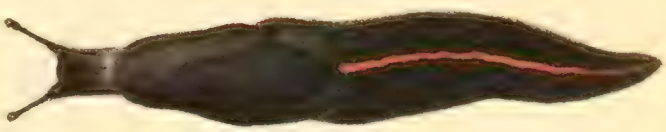
8. *Agriolimax lævis (summer form) p.* 126.
(after Simroth).

12. *Milax gagates var. pallidissima, p.* 146
Guernsey, B. Tomlin.



13. *Milax gagates var. plumbea, p.* 144.
Stafford, L. E. Adams.

14. *Milax gagates var. rava, p.* 145.
Truro, J. H. James.



18. *Milax sowerbii var. bicolor, p.* 157.
Ealing, Middlesex, T. D. A. Cockerell.

19. *Milax sowerbii, subvar. insolita, p.* 156.
Rhyl, Flint, A. Steele Perkins.

20. *Milax sowerbii var. rustica, p.* 156.
Dublin, J. R. Redding.

The effect of insular conditions upon the coloration of this species is well marked; the broad effect being a general similarity which has a marked relationship to the two prevalent varieties characterizing the British Isles.

In Madeira this species is of a more or less dark-brown colour, and has been described as var. *maderensis* Ckll.; it may be regarded as an extreme form of the var. *rava*.

The *M. gagates* of St. Helena, described as forma *helenæ*, partake of the characters of the vars. *plumbea* and *rava*, and the same intermediate features are displayed by the forma *tristensis* Ckll., from Tristan d'Acunha and Juan Fernandez.

The Bermuda specimens on the contrary display a close relationship with the typical form, but show a flexuous keel, and are rather more opaque and rugose than is usual.

The American examples of *M. gagates*, perhaps better known under Cooper's name of *M. hewstoni*, differ but little from typical *gagates*; the body is blackish above, paler at the sides; sole dull greyish ochreous; keel not conspicuous in the living slug, but much stronger when contracted in alcohol. The internal structure agrees also with *gagates* in all essential points, the oviduct being said by Binney to be long and very tortuous, with a well-developed sperm-duct; the vagina very short, the large and globular spermatheca entering about the middle by a very short duct; penis sac small, short, and cylindrical, but expanded and bulbous at the apex, where the vas deferens enters.

FIG. 165.—Median, lateral, and marginal teeth of *M. hewstoni* (highly magnified), after Binney.

FIG. 166.—Sexual organs of *M. hewstoni* (after Binney).

The lingual membrane has a formula of 30 + 1 + 30, with fourteen perfect laterals, and shows symmetrical basal plates, and well-developed endoconic cutting points to inner lateral teeth, but the marginals are not bifurcated.

Var. **bedriagæ** Less. & Poll., Monog. Limac. Ital., 1882, p. 59.

Amalia mediterranea Ckll., Ann. and Mag. N.H., 1891, p. 331.
Amalia mediterranea f. *similis* Ckll., op. cit., p. 332.
Amalia gagates f. *atlantica* Ckll., op. cit., p. 330.

ANIMAL black, lateral areas of the sole blackish.

The sub-var. **mediterranea** Ckll. only differs from the var. *bedriagæ* in its larger size, measuring 56 mill. in length (in alcohol). It is described as of a rather dull black, and though somewhat shiny, quite opaque.

The sub-var. **similis** Ckll. is smaller than the preceding, has an opaque-wrinkly-rugose and black body, a strong and rather flexuous keel; side-areas of sole greyish.

The sub-var. **atlantica** Ckll. is of ordinary dimensions, and also black, slightly transparent at the sides, body smooth, with rugæ not well marked; sole grey and slightly translucent; jaw dark brown with a well-formed median projection.

France—Var. *bedriagæ*, Nice, in the Alpes Maritimes, Signor Bedriaga (Less. & Poll., op. cit.).

Sardinia—Var. *bedriagæ*, Signor Falchi (Less. & Poll., op. cit.).

Sicily—Sub-var. *similis*, Catania (T. D. A. Cockerell, op. cit., p. 332).

Spain—Sub-var. *atlantica*, Gibraltar, J. H. Ponsonby (T. D. A. Cockerell, op. cit., p. 331).

Algeria—Sub-var. *mediterranea*, a specimen from East Algeria in the British Museum, received from Dr. Heynemann (T. D. A. Cockerell, op. cit., p. 331).

The specimens in the British Museum, collected by Dr. Anderson at Hammam Meskontina, and referred to sub-sp. *mediterranea* by Mr. Cockerell, are perhaps better placed under the sub-var. *atlantica*.

Morocco—Sub-var. *atlantica*, Tangiers, J. H. Ponsonby (T. D. A. Cockerell, op. cit., p. 330).

Var. **plumbea** Moq.-Tand., Hist. Moll. France, 1855. ii., p. 19, pl. 6, ff. 1, 2.

Limax (*Amalia*) *gagates* γ *olivaceus* Moquin-Tandon, op. cit., p. 19.

ANIMAL greyish-black or lead colour.

The sub-var. **olivacea** is of a deep olivaceous grey.

Channel Isles—Var. *plumbea*, Guernsey, Aug. 1891 ! B. Tomlin.

Cornwall W.—Var. *plumbea*, garden, Truro Vean Terrace, near Truro, Dec. 1885 ! J. H. James.

Devon S.—Var. *plumbea*, abundant in garden, Topsham, Aug. 1892, L. E. Adams.

Somerset N.—Var. *plumbea*, specimens in British Museum, labelled "Bath, J. E. Daniel" (T. D. A. Cockerell, Ann. and Mag. N.H., 1891, p. 330).

Dorset—Var. *plumbea*, Chideock, Bridport, Aug. 1885 ! A. Belt. Spettisbury, June 1891 ! C. Ashford.

Isle of Wight—Var. *plumbea*, Totlands Bay, Freshwater, June 1885 ! H. P. Fitzgerald.

Hants S.—Var. *plumbea*, Christchurch, Aug. 1884 ! C. Ashford. Hoe Moor (L. E. Adams, Science Gossip, March 1901).

Hants N.—Var. *plumbea*, Preston Candover ! H. P. Fitzgerald.

Middlesex—Var. *plumbea*, Acton, Dec. 1884 ! and Bedford Park, Chiswick, Dec. 1884 ! T. D. A. Cockerell. Hampstead, Dec. 1888 ! H. W. Kew.

Hereford—Var. *plumbea*, garden, Bishopswood Vicarage, Ross, April 1885 ! R. W. J. Smart.

Worcester—Var. *plumbea* and sub-var. *olivacea*, garden, Stourport, July 1888 (J. W. Williams, J. of Conch., July 1889).

Stafford—Var. *plumbea*, Stafford, June 1886 ! L. E. Adams.

Salop—Var. *plumbea*, Oswestry, June 1885 ! Baker Hudson.

Cardigan—Var. *plumbea*, gardens, Aberayron, May 1888 ! Miss Foulkes and Miss Maddy.

Lincoln N.—Var. *plumbea*, Alford, Sept. 1885 ! J. E. Mason.

Notts.—Var. *plumbea*, common in garden, Tuxford, July 1885 ! W. A. Gain.

Cheshire—Var. *plumbea*, nursery gardens, Sale, Feb. 1895 ! C. Oldham.

Durham—Var. *plumbea*, specimens in British Museum, labelled "South Shields, R. Howse" (T. D. A. Cockerell, op. cit.).

Berwick—Var. *plumbea*, roadside, Cockburnspath, Sept. 1890 ! W. Evans.

Derry—Var. *plumbea*, Ballynagard, June 1892, D. C. Campbell.

Antrim—Var. *plumbea*, Cushendun, May 1886 ! Rev. S. A. Brenan.

Down—Var. *plumbea*, common, chiefly in lily of the valley beds, Oakleigh, Ormeau Park, Belfast, 1897, A. W. Stelfox. Common in garden, Sydenham House, April 1898, R. Welch.

Dublin—Var. *plumbea*, Kingstown, May 1886 ! W. F. de Vismes Kane.

Queen's Co.—Var. *plumbea*, La Bergerie (B. J. Clarke, Ann. and Mag. N.H., 1843, p. 341).

Mayo E.—Var. *plumbea*, Tourmakady Lodge near Ballinrobe, Sept. 1843 (B. J. Clarke, op. cit.).

Mayo W.—Var. *plumbea*, Slievemore village, Sept. 1888 ! (J. G. Milne, J. of Conch., Oct. 1891).

Galway W.—Var. *plumbea*, MacDaras Island, Roundstone, July 1895, R. Welch. Sub-var. *olivacea*, Aran Isles, Oct. 1890, R. F. Scharff.

Galway E.—Var. *plumbea*, Tuam Palace gardens (B. J. Clarke, op. cit.).

Kerry—Var. *plumbea*, Kenmare, Sept. 1898, L. E. Adams. In field on Cloonee road beyond Mucksna Wood, Sept. 1898 (Stubbs & Adams, Irish Nat., Nov. 1898).

France—Var. *plumbea* is recorded by Dubrueil from Bédarieux, St. Pons, La Salvetat, and Ganges in the Hérault, and by d'Orbigny from La Rochelle in Charente Inférieure, and we have verified specimens collected in April 1887 at Cherbourg, department Manche, by F. R. Billups, as well as from Veules, Seine Inférieure, collected by S. C. Cockerell, in Sept. 1895. The sub-var. *olivacea* is reported by Moquin-Tandon from Toulouse in Haute Garonne; from Nice in the Alpes Maritimes by Lessona & Pollonera; and by Dubrueil from St. Martin-de-Londres, Ganges, etc., in Hérault.

Malta—Var. *plumbea* (Pollonera, Boll. Mus. Zool. Torino, April 1891).

Spain—Var. *plumbea*, Santiago in Galicia (Macho, Molusc. Galicia, 1871, p. 13).

United States—Var. *plumbea* of the *M. hewstoni* found by H. Hemphill, at Julian City, California (T. D. A. Cockerell, Ann. and Mag. N.H., Nov. 1891, p. 338).

Var. **rava** Williams, Shell Coll. Handbook, 1888, p. 89.

Limax gagates var. γ Clarke, Ann. and Mag. N.H., Nov. 1843, pl. xii., ff. 18-20.
Amalia gagates var. *maderensis* Ckll., Ann. and Mag. N.H., 1891, p. 334.
Amalia gagates var. *ascensionis* (Lesson) Ckll., op. cit., p. 335.
Amalia gagates var. *ascensionis* f. *helenæ* Ckll., op. cit., p. 336.
Amalia gagates var. *ascensionis* f. *tristensis* Ckll., op. cit., p. 336.

ANIMAL drab-coloured, slightly fuscous, the mantle often paler than the back.

The sub-var. *maderensis* Ckll., sub-var. *ascensionis* Lesson, with the forms *helenæ* and *tristensis*, are all apparently forms of the var. *rava*, but the three latter forms have intimate relationship also with the var. *plumbea*, and constitute a series of connecting links between the vars. *rava* and *plumbea*.

The sub-var. **maderensis** Ckll. is of an uniform dark-brown, including the foot; mantle blackish and oval, keel not strong, and median-area of sole more than twice as broad as either lateral zone.

The sub-var. **helenæ** Ckll. is dull palish ochreous, with simple reticulate groovings, the interstitial spaces being similarly but still more delicately sculptured; back darkish purplish-grey, with a strong but not obviously paler keel extending the whole length of the back; neck bluish-grey above; mantle purplish-grey, except on the sides, below the sulcus, which are pale ochreous, rather sharply defined from the dark part by the sulcus; median-area of sole not quite twice as broad as either lateral area.

The sub-var. **tristensis** Ckll. has the rugæ rather strong, back and mantle plumbeous, sole and sides of body yellowish.

The sub-var. **ascensionis** Lesson has a general resemblance to the two preceding related sub-varieties.

Channel Isles—Var. *rava*, Guernsey, numerous, Aug. 1891 ! B. Tomlin.

Cornwall W.—Var. *rava*, garden, Truro, April 1886 ! J. H. James.

Devon S.—Var. *rava*, swarming in Mr. McMurdo's garden, Topsham, Aug. 1892, L. E. Adams.

Hants S.—Var. *rava*, common at Christchurch, Jan. 1887 ! C. Ashford.

Middlesex—Var. *rava*, garden, Hornsey, Oct. 1891 ! H. W. Kew. Crouch Hill, Oct. 1891 ! G. K. Gude.

Oxford—Var. *rava*, near Little Bourton (W. E. Collinge, Conch., 1891, p. 13).

Monmouth—Var. *rava*, Shirenewton Hall, June 1886 ! E. J. Lowe.

Worcester—Var. *rava*, garden, Stourport (Williams, Science Gossip, May 1886).

Carnarvon—Var. *rava*, Conway Castle, Jan. 1888 ! L. E. Adams.

Anglesey—Var. *rava*, Puffin Island, Aug. 1891 ! T. Shankland.

Cheshire—Var. *rava*, nursery gardens, Sale, Feb. 1895 ! and Ashton-on-Mersey, Oct. 1892 ! C. Oldham.

Lancashire Mid—Var. *rava*, Garstang, Sept. 1888 ! W. H. Heathcote.

Edinburgh—Var. *rava*, Levenhall, plentiful, Aug. 1886 ! W.D.R.

Antrim—Var. *rava*, Cushendun, May 1886 ! Rev. S. A. Brenan. Murlough Bay Glen, June 1899, R. Welch.

Down—Var. *rava*, in lily of the valley beds, Oakleigh, Ormeau Park, Belfast, 1897, A. W. Stelfox. Common in garden, Sydenham House, April 1898, and Downpatrick Cathedral grounds, March 1898, R. Welch.

Louth—Var. *rava*, Dundalk, Jan. 1904, C. Oldham.

Dublin—Var. *rava*, Kingstown, May 1886 ! W. F. de Vismes Kane. Whitechurch, Oct. 1890, R. F. Scharff.

Queen's Co.—Var. *rava*, La Bergerie, common (B. J. Clarke, op. cit., p. 339).

Sligo—Var. *rava*, Carrahubback, abundant under stones on low grassy banks, near the sea-shore, Oct. 1892 ! Miss Amy Warren.

Mayo W.—Var. *rava*, Ballina, Oct. 1890, R. F. Scharff. Slievemore village, Sept. 1888 ! (J. G. Milne, J. of Conch., Oct. 1891).

Madeira—Sub-var. *maderensis* Ckll., a specimen in the British Museum, labelled "Madeira, Mr. Mason" (T. D. A. Cockerell, op. cit., p. 334).

Ascension—Sub-var. *ascensionis* Lesson (T. D. A. Cockerell, op. cit., p. 335).

St. Helena—Sub-var. *helenæ* Ckll., a specimen in the British Museum, labelled "St. Helena, J. C. Melliss" (T. D. A. Cockerell, op. cit., p. 336).

Tristan d'Acunha—Sub-var. *tristensis*, a specimen in the British Museum, labelled "Tristan d'Acunha, Challenger Collection" (T. D. A. Cockerell, op. cit., p. 336).

Juan Fernandez—Sub-var. *tristensis*, six specimens in the British Museum, labelled "Juan Fernandez, Challenger Collection" (T. D. A. Cockerell, op. cit., p. 338).

Var. **pallidissima** Pollonera, Boll. Mus. Zool. Torino, April 1891.

Amalia gagates var. *cremiophila* Simroth, Nack. Portug.-Azor. Fauna, 1891, pl. 11, f. 3.

ANIMAL pale grey, sometimes with a lavender tinge.

This distinct variety, which Simroth under the name of var. *cremiophila* regards as a pale steppe form of *Milax gagates*, is not the form described by Bourguignat as *Limax cremiophila*, which in many respects is different, and amongst other features is described as possessing a yellow keel.

Channel Isles—V. *pallidissima*, St. Sampson's, Guernsey, Sep. 1891 ! B. Tomlin.

Hants S.—Var. *pallidissima*, Christchurch, Jan. 1883 ! C. Ashford.

Middlesex—Churchyard Bottom wood, Highgate, April 1889 ! H. W. Kew.

Cardigan Var. *pallidissima*, garden, Aberayron, May 1888 ! W. Whitwell.

Dublin—Var. *pallidissima*, Donnybrook, Aug. 1888 ! G. Barrett-Hamilton.

Portugal—Sub-var. *cremiophila* Simroth, Lisbon and Abrantes in Estremadura, and in the Algarve (Simroth, op. cit.).

Malta—Var. *pallidissima* (Pollonera, op. cit.).

Var. **bicolor** Taylor.

ANIMAL of a deep red on the sides; SHIELD and BACK deep brown.

The var. *raymondiana* as figured by Simroth (Nacktschn. Portug.-Azor. Fauna, pl. 11, fig. 2) has some relations with this variety, but is very much duller in its colours: it is considered by some authors as identical with the var. *maderensis* of Cockerell. The *Limax raymondiana* as figured and described by Bourguignat has the sides of a warm ochreous-yellow.

Channel Isles—St. Sampson's, Guernsey, Sept. 1891 ! B. Tomlin.

Var. **benoiti** Less. & Poll., Monog. Limac. Ital., 1882, p. 59, pl. 1, f. 9.

ANIMAL black, dorsal keel whitish.

According to the Rev. B. J. Clarke, the keel in the young is invariably yellow, but gradually assumes during growth the same tint as the dorsum; the var. *benoiti* may, therefore, be regarded as characterized by the retention to mature life of juvenile coloration.

Simroth considers the *Limax scaptobius* Bourg., from Algiers, Portugal, and Gibraltar, as a young form of *M. gagates*, which has retained the pale keel line.

Edinburgh—A sub-variety of this form with a yellowish keel was found at Levenhall, Aug. 1886, by Mr. W. Denison Roebuck.

Sicily—Messina (Less. & Poll., op. cit.).

Geographical Distribution.—In its natural range *Milax gagates* appears to be restricted to the Western Palæarctic and Mediterranean regions, and presents many analogies with the area of dispersal of *Helix aspersa*.

In the British Isles, *M. gagates* is dispersed more or less interruptedly over the entire area, excepting the northern half of Scotland, from whence it has not as yet been reported.

In the remote oceanic islands and distant countries where the species has been found, its occurrence is probably to be attributed to accidental or unintentional introduction by human agency.

M. gagates has been credited by some authors with being a strictly littoral species, but although perhaps more plentiful along the coast, where it is sometimes found living quite within the influence of the sea spray at high tides, it is by no means restricted to such places, but occurs freely inland.

ENGLAND AND WALES.

Channel Isles Guernsey, at St. Martin's, Aug. 1856 (A. M. Norman, Zool., 1856, p. 5324); St. Peter's Port, 1887; and St. Sampson's, Sept. 1891 ! B. Tomlin.

PENINSULA.

Cornwall W.—Not uncommon (E. D. Marquand, Penzance Trans., 1884). Falmouth, Nov. 1901, H. Overton (J. of Mal., Dec. 1901). Garden, Truro Vean Terrace, Truro, J. H. James ! (T. D. A. Cockerell, Sci. Goss., May 1886, p. 114). Newquay (A. Belt, Sci. Goss., Aug. 1893).

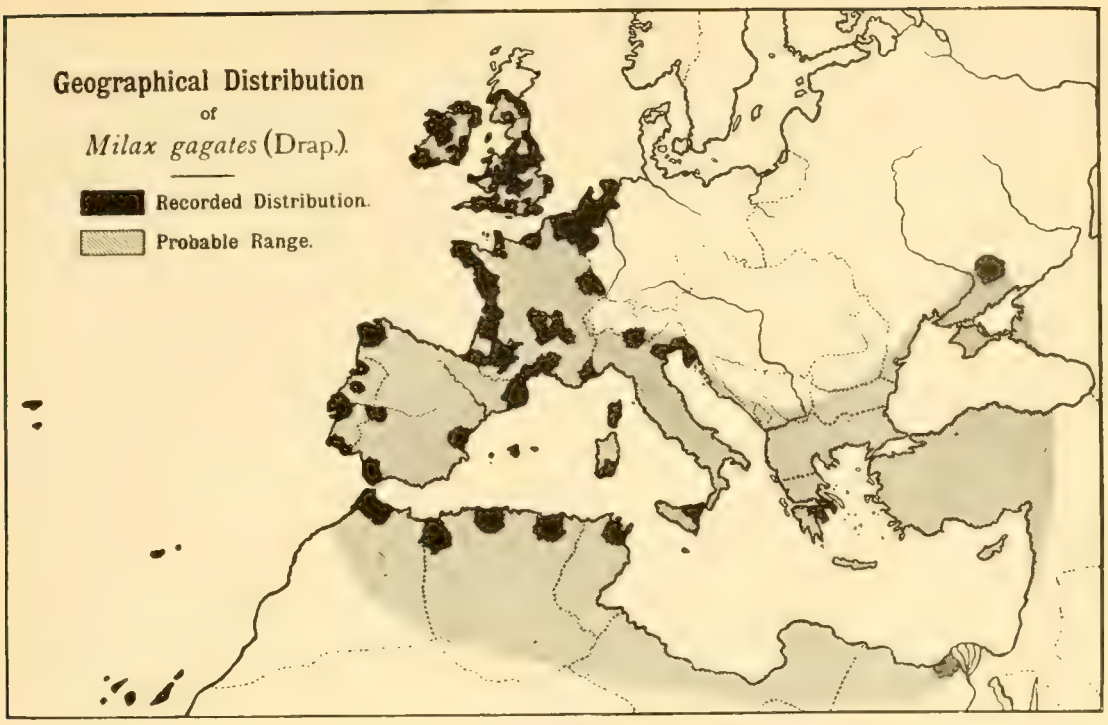


FIG. 167.

Devon S.—Lane beyond Mr. Bartlett's farm, near Torquay, J. P. Norman (A. M. Norman, Zool., 1854, p. 4284). Torquay, April 1888 ! S. Tuke.

Devon N.—Lynton, 1898, F. J. Partridge (J. of Mal., Dec. 1898, p. 19).

Somerset S.—Allotment gardens, near canal and gasworks, Bridgwater, Aug. 1884 ! W. Vinson.

Somerset N.—Specimens in British Museum, labelled "Bath, J. E. Daniel" (T. D. A. Cockerell, op. cit.).

CHANNEL.

Dorset—First found in Great Britain by Mr. R. D. Darbishire at the foot of a hawthorn hedge, Portland, Sept. 1851. Among the quarries, Portland Island, Aug. 1892, L. E. Adams. Spettisbury, June 1888 ! C. Ashford.

Isle of Wight—Plentiful at Sandown, R. Gibbs (Forbes & Hanley, Brit. Moll., 1853, vol. 4, p. 289).

Hants S.—Christchurch, Aug. 1884 ! typical form rare, C. Ashford.

Hants N.—Preston Candover, June 1885 ! H. P. Fitzgerald.

Sussex E.—Hastings, July 1877 ! Miss E. B. Fairbrass. East Rother district, (J. H. A. Jenner, Report Eastbourne Nat. Hist. Soc., 1880).

THAMES.

Kent E.—Chatham ! J. Whitwham.

Kent W.—Beckenham, 1901, F. W. Wilson.

Middlesex—Far from scarce in the gardens, etc., of the North London suburbs; frequently seen by the pathways in Hornsey and Islington ! (H. W. Kew, 1902).

Oxford—Sparingly, near Little Bourton, and near Lidstone (W. E. Collinge, Conchologist, 1891, p. 13).

ANGLIA.

Suffolk E.—St. Margaret's, Ipswich, 1893 (W. M. Webb, J. of Mal., 1893, p. 4).

Norfolk E.—Very plentiful in gardens and in outhouses, North Heigham near Norwich, Oct. 1894 ! A. Mayfield.

Northampton—Mr. Beeby Thompson's garden, Northampton, June 1896 (L. E. Adams, Journ. Northants Soc., 1896, p. 60).

SEVERN.

Monmouth—Kitchen gardens, Shirenewton Hall near Chepstow, May 1886 ! E. J. Lowe.

Hereford—Bishopswood ! Rev. R. W. J. Smart.

Worcester—Abundant, Stourport (J. W. Williams, Science Gossip, 1886, p. 99).

Warwick—Camp Hill, Birmingham ! W. Nelson. Garden, Sutton Coldfield, 1902 (H. Overton, J. of Mal., 1901, p. 124).

Stafford—Grounds of Grammar School, Stafford, June 1886 ! L. E. Adams.

Salop—Oswestry, June 1885 ! Baker Hudson.

SOUTH WALES.

Pembroke—Old Carmarthen road, Tenby, July 1853, A. Merle Norman (Zool., 1853, p. 4048). Deer Park, also on North and South Cliffs, but scarcer than *M. sowerbii* (A. G. Stubbs, J. of Conch., July 1900, p. 321).

Cardigan—Mrs. Maddy's garden, Aberayron, May 1888 ! W. Whitwell.

NORTH WALES.

Montgomery—Garden, Welshpool (J. Bickerton Morgan, Moll. Montgom., 1891).

Carnarvon—Conway Castle and railway station, Jan. 1888 ! L. E. Adams.

Anglesey—Var. *rava*, Puffin Island, Aug. 1891 ! T. Shankland.

TRENT.

Lincoln N.—Parson's lane, Alford, May 1886 ! J. E. Mason.

Notts.—Tuxford, rare (B. Sturges Dodd, Brit. Assoc. Handbook, 1893, p. 71).

Derby—Matlock, J. A. Howe.

MERSEY.

Cheshire—Ashton-on-Mersey, Sept. 1890 ! and Sale, Sept. 1892 ! C. Oldham.

Lancashire S.—Common in Swinton School gardens (J. C. Melvill, Brit. Assoc. Handbook).

Lancashire Mid—Garstang, Sept. 1888 ! Fulwood near Preston, Feb. 1889 ! W. H. Heathcote.

HUMBER.

York S.E.—Withernsea, on the cliffs, Sept. 1891 ! J. D. Butterell.

York N.E.—Kitchen gardens opposite Borough road, Middlesbrough, Sept. 1886 ! T. A. Lofthouse.

York S.W.—Bridge at Fall Ing, Wakefield (J. Hebden, Quart. Journ. Conch., 1874, p. 5). Shibden near Halifax, 1859, W. Cash. Huddersfield, very rare (G. H. Parke, in Hobkirk's Huddersfield, 1868, p. 224).

TYNE.

Durham—South Shields, R. Howse. Several places in Durham, including the garden of Burnmoor Rectory, Fencehouses ! (A. M. Norman, Ann. and Mag. N.H., 1890, p. 329).

LAKES.

Isle of Man—Peel Castle (Forbes & Hanley, British Moll., 1853, vol. 4, p. 25). Roadside near Onchan, Sept 1891 ! Port Erin, Aug. 1892, H. Overton. Castletown, Aug. 1894, F. Taylor.

SCOTLAND.

WEST LOWLANDS.

Dumfries—Dumfries, March 1897, R. Service.

EAST LOWLANDS.

Berwick—Roadside, Cove Farm near Cockburnspath, Sept. 1890 ! W. Evans.

Edinburgh—Levenhall near Musselburgh, Aug. 1886 ! W.D.R. Garden, Morningside, Edinburgh, Aug. 1889 ! W. Evans.

EAST HIGHLANDS.

Perth S. and Clackmannan—G. McDougall.

WEST HIGHLANDS.

Dumbarton—Dumbarton, common, Aug. 1886 ! W. Denison Roebuck.

Clyde Isles—Grounds of College, Isle of Cumbrae, 1854 (A. Merle Norman, Zoologist, 1856, p. 5324). About the Aquarium, Rothesay, Isle of Bute, Nov. 1886 ! T. Scott.

IRELAND.

ULSTER.

Derry—Ballynagard, June 1892, D. C. Campbell.

Antrim—Cushendun, May 1886 ! S. A. Brenan. Rathlin Island, May 1897, L. E. Adams.

Down—Cultra, Dec. 1891, R. L. Praeger (Scharff, Irish List, 1892, p. 9). Downpatrick Cathedral grounds, Oct. 1897, R. Welch. Common in garden, Oakleigh, Ormeau Park, Belfast, especially in lily of the valley beds, 1897, A. W. Stelfox.

Donegal—In old wood, near Ardara, April 1900, R. Welch.

LEINSTER.

Louth—Var. *rava*, Dundalk, Jan. 1904, C. Oldham.

Meath—Lough Ballyhoe, typical black form, April 1904 ! P. H. Grierson.

Dublin—Near Dublin, Dr. Robert Ball (Forbes & Hanley, Brit. Moll., 1853, vol. 4, p. 25). Donnybrook, Aug. 1888 ! G. Barrett Hamilton. Raheny, Sept. 1890, and Whitechurch, Oct. 1890, R. F. Scharff. Dellbrook, Dundrum, 1897, R. Welch.

Wicklow—Kilruddery, also Murrough of Wicklow, June 1891, R. F. Scharff.

Carlow—Near Carlow, Nov. 1901, A. G. Stuart.

Queen's Co.—La Bergerie (B. J. Clarke, Ann. Nat. Hist., 1843, p. 341).

CONNAUGHT.

Sligo—Var. *rava*, Carrahubback, Oct. 1892 ! Miss Amy Warren.

Mayo E.—Tourmakady Lodge near Ballinrobe, Sept. 1843 (B. J. Clarke, Ann. Nat. Hist., 1843, p. 339).

Mayo W.—Common in garden, Moyview, Ballina (Amy Warren, Zoologist, 1879, p. 25). Dugort and Slievemore, Achill Island, Sept. 1888 ! (J. G. Milne, J. of Conch., Oct. 1891).

Galway E.—Var. *plumbea*, Tuam Palace gardens (B. J. Clarke, op. cit.).

Galway W.—Clifden, Connemara, July 1840 (W. Thompson, Ann. Nat. Hist., 1840, p. 205). Aran Isles, Oct. 1890, R. F. Scharff.

MUNSTER.

Cork N.—Queenstown, May 1891, R. F. Scharff. Under stones in the open country near Castle Martyr (Forbes & Hanley, Brit. Moll., 1853, p. 25).

Cork S.—Between Bantry and Glengariff, Sept. 1898 (Stubbs & Adams, Irish Nat., Nov. 1898).

Kerry—Garden, Lake Hotel, Killarney, autumn, 1853, J. P. Norman (A. Merle Norman, Zool., 1854, p. 4284). Under arbutus trees in Middle Cloonee Lake, Mr. Ragdale (R. Standen, Irish Nat., Sept. 1898). Sparingly in old damp mossy woods, Kenmare, July 1898, R. Welch.

NETHERLANDS.

Belgium—Malines (Van Beneden); between Wechter and Tremelos (Kickx); and found rather abundantly in May near the great lake of Quincampois by Carlier (Colbeau, Mem. Soc. Mal. Belg., 1865, p. 84).

Holland—(Simroth, Nacktschn. Portug.-Azor., 1891, p. 295).

FRANCE.

M. gagates, though found more especially in the littoral departments, is also present at many inland stations, and has been recorded for Aude, Alpes Maritimes, Basses Pyrénées, Charente Inférieure, Finistère, Gard, Gers, Gironde, Haute Garonne, Haute Loire, Hérault, Isère, Loire Inférieure, Manche, Morbihan, Moselle, Nord, Pyrénées Orientales, Puy-de-Dôme, Rhone, Seine Inférieure, Tarn et Garonne, Vendée, Vosges, and the Island of Corsica.

ITALY.

This species has been recorded by Pini from Monte Codeno and Monte Campioni, and the northern valleys of Lombardy, and Mr. Brockton Tomlin has found it in Sept. 1886 on the Monte Moro Pass at an altitude of 7,000 feet. It abounds in the public gardens of Venice, according to Pini, and has been found by Pirona at Friuli in the Udine. It has been recorded for Sicily by Tate and others, for Malta by Mamo and Pollonera, while Heynemann gives it as inhabiting Sardinia.

AUSTRO-HUNGARY.

Only reported from the neighbourhood of Trieste in Istria (Pini, Bull. Soc. Mal. Ital., 1876, p. 107), and from Görz in Goritz by Erjavec (Heynemann, Jahrb. Deutsch. Mal. Gesell., 1885, p. 254).

SPAIN AND PORTUGAL.

Spain—It is recorded for Catalonia by Graells; from Santiago in Galicia by Macho; as common in the gardens of the city of Valencia by Hidalgo; from the coast near Cadiz by Bourguignat; from Gibraltar in Andalusia by J. H. Ponsonby; from Alcantara in Estremadura by Simroth; and from the Balearic Isles by Heynemann.

Portugal—Simroth records this species from Braga in Minho; Coimbra and Guarda in Beira; and also from Cintra, Abrantes, the botanical gardens of Lisbon in Estremadura, and from the Algarve.

BALKAN PENINSULA.

Greece—Specimens forwarded from Greece in Sept. 1891 ! by Mr. J. G. Milne.

RUSSIA.

Reported as inhabiting the district of Izium, in the province of Kharkov (Kaleniczenko, Bull. Moscow, 1851, p. 126).

NORTH AFRICA AND ASIA MINOR.

Morocco—Mountains of Tetuan (Bourguignat, Mal. Alg., p. 318), and Cape Spartel (Morelet, J. de Conch., 1880, p. 16).

Algeria—About Constantine, Tlemcen, Aïn-el-Haout (Bourguignat, op. cit., p. 48), Algiers (Lallemant, Mem. Soc. Mal. Belg., 1868, p. 24), and Oran (Tournier).

Tunis—At foot of Djebel Abdellah near Cap Roux; Ariana near Tunis (Bourguignat); and at Djebel Reças (Letourneux & Bourguignat, Mal. Tunisie, 1887).

Egypt—(Scharff, Slugs of Ireland, 1891, p. 535).

ATLANTIC ISLES.

Azores—Universal, inhabiting every isle of the group (Wollaston, Test. Atl., 1877, p. 10).

Madeira—Extremely common in Madeira, on cultivated land and elsewhere, up to an altitude of 3,000 feet (R. B. Watson, J. de Conch., 1876, p. 221). Found around Funchal, at the Pico do Infante and other places. Mr. Lowe found it near Alegria, at the Mount in Cayados Ravine, and also at the summit of the Pico do Castello on Porto Santo (Wollaston, Test. Atl., 1877, p. 69).

Canaries—Extremely common (Simroth, Nachrichtsbl., 1895).

Ascension—(T. D. A. Cockerell, Science, June 23, 1893).

St. Helena—(E. A. Smith, Proc. Zool. Soc., 1884, p. 278).

Tristan d'Acunha—Obtained by the Challenger Expedition (Smith, op. cit.).

NEARCTIC REGION.

Idaho—*Milax hewstoni*, Cœur d'Alene, H. F. Wickham (T. D. A. Cockerell, Ann. and Mag. Nat. Hist., Nov. 1843, p. 337).

Washington State—*M. hewstoni*, Seattle (Cockerell, op. cit.).

Pennsylvania—*M. hewstoni*, Phipps' Conservatory, Schenley Park, Pittsburgh, G. H. Clapp.

California—*Milax hewstoni*, first noticed about 1885 on the grass plots of San Francisco; it soon became abundant, and has extended its range to Seattle, Washington State, in the north and San Diego in the south (R. E. C. Stearns, Science, April 27, 1900, p. 655). About Williamstown University, Los Angeles Co. (M. Burton, Nautilus, Jan. 1890). Oakland, 1890, H. Hemphill; Santa Barbara, Miss Cusack; Haywards, Feb. 1890, Dr. J. G. Cooper (T. D. A. Cockerell, op. cit., p. 337).

Mexico—*Milax hewstoni*, near overflow of San Tomas river, Lower California (H. Hemphill, J. de Conch., 1881, p. 35).

NEOTROPICAL REGION.

Brazil—(Heynemann, op. cit.).

Bermuda—Obtained by the Challenger Expedition (E. A. Smith, op. cit., p. 276).

Juan Fernandez—Collected by the Challenger Expedition (E. A. Smith, Proc. Zool. Soc., 1884, p. 279).

ETHIOPIAN REGION.

Cape Colony—Obtained in Nov. 1873 at Cape of Good Hope by the Challenger Expedition, probably the *Limax capensis* Krauss (E. A. Smith, op. cit., p. 276). Port Elizabeth, J. H. Ponsonby (T. D. A. Cockerell, op. cit., p. 337).

Natal—(Melvill & Ponsonby, Proc. Mal. Soc., 1898, p. 172).

AUSTRALASIAN REGION.

New South Wales—Tamworth, C. T. Musson; Gladesville, H. Deane; abundant about Sydney, J. Brazier; under stones at Darling Point, near Sydney, in company with *Agriolimax agrestis*, G. Neville (C. T. Musson, Proc. Linn. Soc. N.S.W., 1890, p. 891).

Victoria—Ballarat, under garden rubbish, stones, and wood, also on cabbages, coming out at night and early morning (C. T. Musson, op. cit.).

New Zealand—Ohaupo and Auckland (C. T. Musson, op. cit.).

Sandwich Islands—Isle of Maui (Collinge, Proc. Mal. Soc., 1896, p. 49).

Distribution of *Milax gagates* (Drap.)

In the Counties and Vice-Counties of the British Isles.

ENGLAND AND WALES.

Channel Isles

PENINSULA
1 Cornwall W.
2 Cornwall E.
3 Devon S.
4 Devon N.
5 Somerset S.
6 Somerset N.

CHANNEL
7 Wilts N.
8 Wilts S.
9 Dorset
10 Isle of Wight
11 Hants S.
12 Hants N.
13 Sussex W.
14 Sussex E.

THAMES
15 Kent E.
16 Kent W.
17 Surrey
18 Essex S
19 Essex N.
20 Herts.
21 Middlesex
22 Berks.
23 Oxford
24 Bucks.

ANGLIA
25 Suffolk E.
26 Suffolk W.
27 Norfolk E.
28 Norfolk W.
29 Cambridge
30 Bedford
31 Hunts.
32 Northampton

SEVERN
33 Gloucester E.
34 Gloucester W
35 Monmouth
36 Hereford
37 Worcester
38 Warwick
39 Stafford
40 Salop

SOUTH WALES
41 Glamorgan
42 Brecon
43 Radnor
44 Carmarthen
45 Pembroke
46 Cardigan

NORTH WALES
47 Montgomery
48 Merioneth
49 Carnarvon
50 Denbigh
51 Flint
52 Anglesey

TRENT
53 Lincoln S.
54 Lincoln N.
55 Leic. & Rutld.
56 Notts.
57 Derby

MERSEY
58 Cheshire
59 Lancashire S.
60 Lancashire Mid

HUMBER
61 S.E. York
62 N.E. York
63 S.W. York
64 Mid W. York
65 N.W. York

TYNE
66 Durham
67 Northumb. S.
68 Cheviotland

LAKES
69 Westmorland and L. Lancs.
70 Cumberland
71 Isle of Man

SCOTLAND.

W. LOWLANDS
72 Dumfries
73 Kirkcudbright
74 Wigtown
75 Ayr
76 Renfrew
77 Lanark

E. LOWLANDS
78 Peebles
79 Selkirk
80 Roxburgh
81 Berwick
82 Haddington
83 Edinburgh
84 Linlithgow

E. HIGHLANDS
85 Fife & Kinross
86 Stirling
87 Perth S. & Clkn
88 Mid Perth
89 Perth N.
90 Forfar
91 Kincardine
92 Aberdeen S.

E. HIGHLANDS
93 Aberdeen N.
94 Banff
95 Elgin
96 Easterness

W. HIGHLANDS
97 Westerness
98 Main Argyle
99 Dumbarton
100 Clyde Isles
101 Cantire
102 Ebudes S.
103 Ebudes Mid
104 Ebudes N

N. HIGHLANDS
105 Ross W.
106 Ross E.
107 Sutherland E.
108 Sutherland W.
109 Caithness

NORTH ISLES
110 Hebrides
111 Orkneys
112 Shetlands

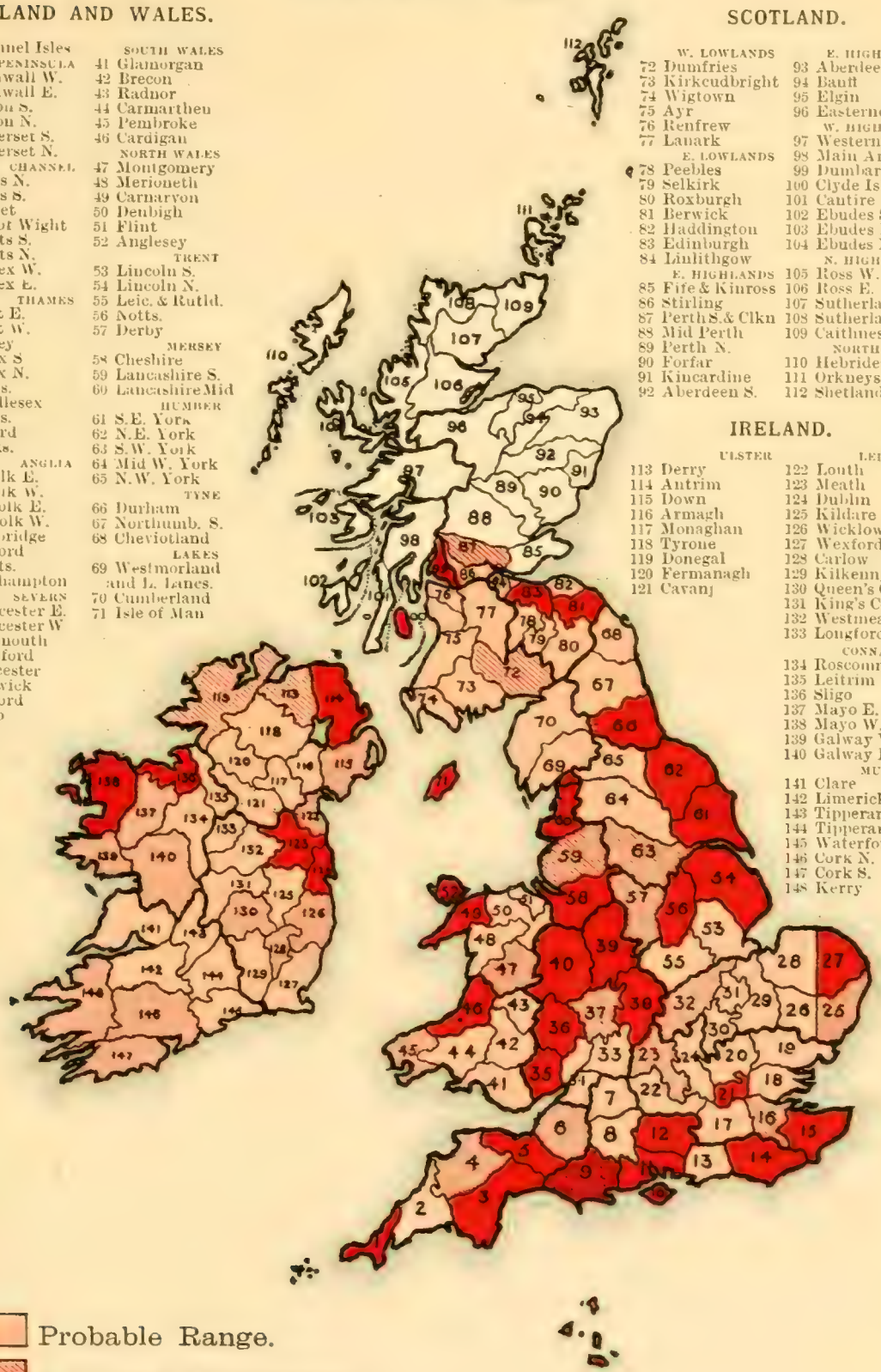
IRELAND.

ULSTER
113 Derry
114 Antrim
115 Down
116 Armagh
117 Monaghan
118 Tyrone
119 Donegal
120 Fermanagh
121 Cavan

LEINSTER
122 Louth
123 Meath
124 Dublin
125 Kildare
126 Wicklow
127 Wexford
128 Carlow
129 Kilkenny
130 Queen's Co.
131 King's Co.
132 Westmeath
133 Longford

CONNAUGHT
134 Roscommon
135 Leitrim
136 Sligo
137 Mayo E.
138 Mayo W.
139 Galway W.
140 Galway E.

MUNSTER
141 Clare
142 Limerick
143 Tipperary N.
144 Tipperary S
145 Waterford
146 Cork N.
147 Cork S.
148 Kerry



Probable Range.

Recorded Distribution.

Distribution verified by the Authors.

Fossil Distribution.

Milax sowerbii (Férussac).

1823 *Limax* **sowerbii** Férussac, Hist. Moll., Suppl., pl. 8D, f. 7, p. 96 ?.
1826 — *carinatus* Risso, Hist. Nat. Moll. Medit.
1852 — *carinatus* Leach, Moll. Gt. Brit., p. 54, pl. 8, f. 3.
1856 — *argillaceus* Gassies, Act. Soc. Linn. Bord., p. 232.
1862 — *marginatus* Jeffreys, Brit. Conch., p. 132.
1831 *Limacellus unguiculus* Turton, Manual, p. 25.
1855 **Milax** *sowerbyi* Gray, Cat. Pulm. Brit. Mus., p. 175.
1896 *Amalia sowerbyi* Adams, Man. Brit. Land Freshw. Shells, p. 32, pl. 1, f. 10.

Mario Lessona

HISTORY. — *Milax sowerbii* was probably first described by Leach, but his description and figure, though privately circulated, were not actually published until 1852, at which date Dr. J. E. Gray edited and issued the work Leach had in great part prepared. *Milax sowerbii* was, however, prior to that date, carefully figured and described by Férussac from specimens sent from the neighbourhood of London by Mr. G. B. Sowerby, to whom he dedicated the species.

The name *sowerbii* is adopted for our British form in the belief that the *Limax marginatus* of Draparnaud is not identical with our species.

With this species the distinguished Italian limacologist, Signor Mario Lessona, is associated, as a mark of appreciation of his malacological labours and more especially in recognition of the sterling merits of the important work, "Monographia dei Limacidi Italiani," written in collaboration with Signor Pollonera, which is undoubtedly one of the most authoritative and standard publications upon the European slugs.

Diagnosis.—EXTERNALLY, *Milax sowerbii* may be distinguished from *M. gagates* by the prominent keel being usually markedly paler than the general colour of the body, and most strongly accentuated on the back; the body sculpture also shows distinct though flattened rugæ, with their interstices more or less marked by black or blackish pigment.

INTERNALLY, it is easily separable from its congener, by its long and tapering spermatheca, an organ which in *M. gagates* is quite globose.

Description.—ANIMAL laterally compressed, with its height little exceeded by its length when contracted, but reaching to 75 mill. or more in length when adult and fully extended; the BODY is comparatively dry and furrowed on each side by about fourteen longitudinal grooves, parallel with the keel, but sometimes forking backwards, and connected by numerous transverse channels which form a flat tuberculation; it is typically of a grey ground colour, but a yellow shade is given to the body owing to its being closely and densely beset with orange-coloured specks, which become sparser towards the foot-margins; the usual darker aspect of the animal is due to the back and sides being closely besprinkled with black, the dots being less numerous towards the sole, but more closely aggregated in the interstices

of the rugæ, thereby defining them very distinctly, and giving a reticulate appearance when the animal is contracted; KEEL of an amber colour, very distinct and prominent on the back, the caudal end scarcely prominent, and hardly differing in colour from the general aspect of the body; SHIELD about one-third the total length of the animal, granularly wrinkled; the protuberant, somewhat lenticular area extends to the posterior margin, is rounded on the left-side, but angulated on the right, and defined by a distinct sulcus, which is further accentuated by the closer aggregation therein of the black specks, which are sprinkled over the whole shield, but more especially upon the posterior mid-dorsal portion overlapping the keel; TENTACLES thick, short, conical, and black, their granulate surface finely sprinkled with ochre-yellow, apices swollen and somewhat oval with black eye specks; NECK with the usual paired dorsal grooves, which on the forehead bifurcate and form four pale parallel lines; FOOT pale, and tripartite, the median area broadest and slightly darker posteriorly owing to its translucency; FOOT-MARGIN smooth, yellowish-white, bounded by a distinct groove above, upon which rests a single row of tubercles, which are separated from the sides of the body by a deep channel. MUCUS thick and viscous, and usually colourless, but when the animal is irritated or scalded may become of an orange tint; when the slime is removed the animal loses much of its yellow colour, which is thus partially due to its slime.

SHELL oblong-oval, glistening white in colour, with a somewhat iridescent lustre in parts, usually slightly convex on the upper side, and in young shells correspondingly concave beneath, but often flat or slightly convex and somewhat irregular in more aged specimens; APEX or nucleus prominent, nearly median, and sub-terminal in the young but becoming more centrally placed as maturity advances; the concentric LINES OF GROWTH variable, but sometimes very distinct and somewhat rugged and yellowish on the upper side.

FIG. 169.—Internal shell of *Milax sowerbii*, × 4. (Christchurch, Hants S., Mr. C. Ashford).

Length, 5 mill.; breadth, 3 mill.

INTERNALLY, the NERVE-RING has the inferior ganglia intimately fused together; the supra-œsophageal ganglia are large and elongately triangular with thickish commissures; the HEART, KIDNEY, and LUNG cavity have the same general locative relations as in the field-slugs; the heart is as usual on the left front of the kidney, and the AORTA runs for a tolerable distance before dividing, as in *Limax flavus*; the kidney, however, is not a roundish sac, but is in two sections, one extending forward in the usual way, the other being a long pointed lobe which extends over towards the right on the lung floor, beneath the ureter and the gut; the URETER is slender throughout its course.

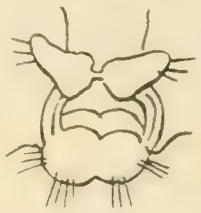


FIG. 170. — Nerve centres of *M. sowerbii* (greatly enlarged).

The REPRODUCTIVE ORGANS open exteriorly beneath the anterior margin of the mantle, about mid-way between the pulmonary aperture and the base of the right ommatophore; the OVOTESTIS is generally concealed within the lobes of the digestive gland, the acini are whitish, large, globular, and rather loose, the ducts combining to form the main stem near the centre of the mass; DUCT rather long, first portion slender and straight, becoming thick and convoluted as it approaches the small, curved, and clavate VESICULA SEMINALIS; ALBUMEN GLAND many-lobed and amber coloured; OVISPERMATODUCT firmly united and strongly twisted; OVIDUCT rather solid, buff or flesh colour, and very thick and difficult to unfold; FREE OVIDUCT as long as the spermatheca and its duct, cylindrical and narrow, receiving at its base the numerous delicate ducts from the multitude of anastomosing tubular glands, which constitute the vestibular prostate; SPERM DUCT broad, well-developed, milk-white or buff; VAS DEFERENS long, entering near apex of epiphallus; the male organ is surmounted by a very stout, thick-walled, and muscular EPIPHALLUS, is annularly ridged internally, abruptly flexed and separated from the penis-sheath by a conspicuous sphincter muscle, denoted internally by a ring of white prominence and exteriorly by a raised ring; the PENIS SHEATH is narrow and cylindrical with thinnish walls and internal longitudinal ridges; it opens into the atrium or vestibule at the side below the opening of the stem of the spermatheca, the SARCOBELUM or stimulatory organ being a small bent horn at the opening of the penis sheath into the atrium; immediately above the sphincter a short stout RETRACTOR is affixed to the convex side of the epiphallus; it arises from the dorsum

in front and to the right of the cephalic retractor; in addition there are a number of muscular fibres which bind the apex and concave side of the epiphallus to the base or to the atrium; the SPERMATHECA in adults is shaped like a long-necked

FIG. 171.—Alimentary tract of *Milax sowerbii*, showing the buccal bulb and nerve-ring, × 2.

FIG. 172.—Sexual organs of *Milax sowerbii*, × 3, the accessory glands turned aside to show the character of the atrium. *alb.gl.* albumen gland; *ot.* ovotestis; *sp.* spermatheca; *sp.d.* sperm duct; *p.s.* penis sheath; *ep.* epiphallus; *r.* retractor; *gl.* accessory glands.

FIG. 173.—Cephalic retractors of *Milax sowerbii*, × 8.

Florence flask, the apex is attached to the ovi-seminal duct, and the base well defined from the narrower but short and slightly inflated stem, which is regularly and strongly plicated internally, and joins the free oviduct just before entering the ATRIUM; the VESTIBULAR GLANDS consist of a multitude of long, slender, opaque, and buff-coloured tubules, more or less ramified and inter-connected, their ducts discharging into the base of the oviduct at the point where the spermatheca enters and into which organ the secretion is directed; the atrium is comparatively large and fleshy, with ample outlet; the SPERMATOPHORE in shape may be likened to the head of a Bishop's crozier with a short staff, the curved portion armed with three or more subspiral rows of recurved denticles, many of which are tricuspid or even multicuspid; the straight lower portion is conically diminished, glistening pearly-white, perfectly smooth and open at the end. It agrees exactly with the spermatophore of *Milax hessei* Böttger, which should probably be placed amongst the synonyms of this species, but differs from the spermatophore of *Milax marginatus*, which is described as armed with denticles throughout its entire length.

FIG. 174.

FIG. 175.

FIG. 174. — Spermatophore of *Milax sowerbii*, × 8 (from a micro-photograph).

FIG. 175.—Spinules from the spermatophore of *M. sowerbii* (greatly enlarged).

The ALIMENTARY SYSTEM in our British form has about half-a-turn less twist than the continental *Milax marginatus*; the ŒSOPHAGUS is about six mill. long, and obscurely striped; the CROP blackish-brown and bent, with the white and rather compact SALIVARY GLANDS attached at opposite sides; the general plan of the INTESTINAL TRACT is triodromous, and very similar to the arrangement in *Milax gagates*; the DIGESTIVE GLAND is of a dull chestnut-brown, the right lobe extending to the end of the body cavity, and twisted round with the intestine; the left lobe is smaller, and extends forward towards the kidney; the hepatic arterial branches are white, and extend over the surface of the intestines, binding the whole mass intimately together.

The CEPHALIC RETRACTOR arises from the dorsum at the posterior margin of the lung chamber; the PHARYNGEAL MUSCLE is most usually though not invariably independent of the TENTACULAR RETRACTORS, but their roots arise in close proximity; it is very deeply cleft, bifurcating just before reaching the nerve ring, while the tentaculars divide half-way to the nerve collar, exactly at and under the part of the shell which is firmly attached to the floor of the sac,

The MANDIBLE or jaw is of arcuate form and deep amber colour, and the chitinous continuation which extends over the upper surface of the mouth cavity is in this species well marked and distinctly striated; the line of bedding within the tissues of the head is marked with a dark line; the median beak or rostrum is distinct, prominent, and somewhat pointed.

FIG. 176.—Mandible or jaw of *M. sowerbii*, × 12.

The LINGUAL MEMBRANE has the teeth not so compactly arranged as in *Milax gagates*, and the individual teeth are broader, though displaying the same distinctly tricuspid median and inner lateral teeth; the endocone, however, becomes gradually lost as the margins are approached, and the marginals are simply aculeate, though some show a distinct tendency to ectoconic bifurcation.

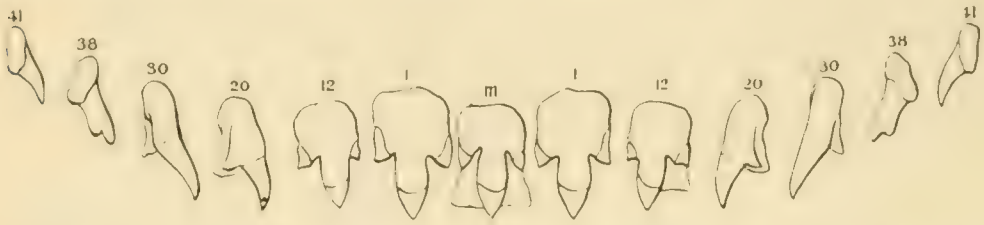


FIG. 177.—Representative denticles from a transverse row of the lingual teeth of *M. sowerbii*, ×180. The animal collected at Dundrum, Ireland, by Dr. Scharff, and the palate prepared by Mr. W. Moss.

The formula of a Dundrum specimen, collected by Dr. Scharff, was

$$\frac{2\,9}{1\text{-}2} + \frac{1\,2}{3} + \frac{1}{3} + \frac{1\,2}{3} + \frac{2\,9}{1\text{-}2} \times 105 = 8{,}715.$$

Reproduction and Development.—The conjugation of *M. sowerbii*, though probably occurring throughout the year, is more frequently observed during the colder months. The operation, as in *M. gagates*, is very prolonged, usually occupying three to four hours, and Mr. Kew observed one instance in which the union extended over the space of seventeen hours. The act is consummated by the mutual transference of the elaborate spermatophores, the smooth, attenuated end of which enters the spermatheca first,[1] and fills and deflects the narrowed prolongation of that organ, sometimes so abruptly as to rupture its moorings to the oviduct; occasionally a second pairing may take place at so short an interval that a second spermatophore may become lodged in the spermatheca before the disintegration of the first has taken place.[2]

FIG. 178.—Spermatheca of *Milax sowerbii*, shewing deflection of apex, due to the presence of the spermatophore (enlarged).

The eggs, which are comparatively large, being about five mill. in their longest diameter, are deposited in clusters of a dozen or more in the soil; they are oval in shape, soft and elastic, of a golden-brown colour, and possessing a coriaceous white freckled though translucent envelope, which when placed in spirit changes to an opaque white. The progress of their development and the later history has not been observed.

Food and Habits. *Milax sowerbii* is subterranean and gregarious in habit, being often found during the day huddled together in worm-holes several inches below the surface; it also hides at the roots of plants, amongst decaying vegetation, in crevices of old walls, under stones, etc., coming forth during wet weather or at night-fall and retiring at daybreak to the subterranean retreats, into which bits of stalks are frequently dragged to feed on at leisure. It is usually not of common occurrence in the open country, but is in places one of the most abundant garden slugs, preferring soil of a stiff clayey character, owing to its better retention of moisture and the greater prevalence of worm-burrows therein. It is very

1 Monog. i., p. 376, ff. 700, 701. 2 Monog. i., p. 374, f. 691.

destructive to bulbs and tubers and also to flowering plants of many kinds; it will devour fresh or decaying fungi, partially decayed cabbages and other vegetables or fruit, and even carrion does not come amiss.

Its diet is, however, not restricted to such pabulum, as it is also actively predatory, and will attack and devour live worms, slugs, and even smaller or weaker individuals of its own kind, though amply provided with suitable vegetable food. In captivity Mr. Gain offered it 196 varieties of food, 152 of which were more or less nibbled, while 74, however, were quite readily taken, though only potato, carrot, and *Boletus edulis* were eagerly devoured.

The animal is of quite inactive habits, crawling slowly, often resting, and when doing so, or when touched or disturbed, withdrawing its head beneath the mantle and shrinking to about half its length, contracting itself almost into a semicircle; when thus contracted the keel becomes sinuous and parts of the body appear indented as though injured at those points.

Its tenacious mucus enables it, especially when young, to readily form mucus threads for the purpose of descending to the ground or to a lower level, although during the operation the ordinary crawling position of the body is not maintained, but becomes so much twisted that the dorsal and ventral surfaces of the body may be presented to view together.

The body slime may also at times cause the adherence of particles of earth to the skin, and the animal then closely resembles a lump of earth, assimilating thus to the ground upon which it rests.

Fossil.—*M. sowerbii* is cited by Jeffreys as an Upper Tertiary fossil, but the record was probably based on an erroneous identification; it has, however, been definitely reported from the Holocene deposits at Maidstone, East Kent, by Kennard & Woodward, and found by Mr. A. S. Kennard at the base of a rainwash deposit associated with bone fragments and Roman pottery, on the site of Roman buildings at Darenth in West Kent.

Parasites.—Like *M. gagates*, it is very liable to be infested with an *Acarus*, probably the *Philodromus limacum*, these in some cases being so numerous as probably to cause some inconvenience to their host.

Variation.—*Milax sowerbii* has been observed to vary in its external colouration from pure white, through yellow, grey, or brown, to an almost uniformly black colour.

Generally speaking, this species is not a very variable one, and the modifications that take place seem to be mainly due in the darker varieties to the increase or diffusion of the black pigment, and in the paler forms to its more or less complete suppression.

This pigmentation may also be more or less restricted in the area occupied, and become correspondingly intensified, as in the var. *bicolor*, in which the coloration becomes greatly enriched.

The Sicilian variety *oretea* is remarkable for the development of a longitudinal median zone of black pigment on the shield, a feature not previously remarked in the species.

The *M. marginatus* var. *fulva* of Paulucci is, according to Lessona & Pollonera, merely a juvenile form of *M. carinata*.

VARIATIONS IN COLOUR AND MARKINGS OF ANIMAL.

Var. **alba** Taylor.

ANIMAL entirely white.

Pembroke—Tenby, A. G. Stubbs.

Var. **pallidissima** Less. & Poll., Monog. Limac. Ital., 1882, p. 56.

Amalia carinata β *pallidissima* Less. & Poll., op. cit.
Amalia sowerbii var. *flavescens* W. E. Collinge, J. of Mal., Dec. 1898, p. 17.
Amalia carinata γ *insolita* Less. & Poll., op. cit.

ANIMAL similar to type form, but very pale.

The sub-v. **insolita** L. & P. differs only in the sulcus of shield being unpigmented.

The sub-var. **flavescens** Collinge, has the sides of the body yellowish; dorsum light grey; foot-sole yellow.

Devon N.—Sub-var. *flavescens*, Lynton and Barnstaple, F. J. Partridge.

Italy—Var. *pallidissima*, Salerno near Naples, and sub-var. *insolita*, Camporbiano near Siena, Tuscany, Marchesa Paulucci (Less. & Poll., op. cit.).

Var. **casertana** Less. & Poll., Monog. Limac. Ital., 1882, p. 56.

Amalia carinata var. *casertana* Less. & Poll., op. cit.

BODY maculate with irregularly diffused, minute, blackish spots, and the black lineoles on the back obsolete; SHELL solid, flat above, irregularly convex beneath.

Italy—Caserta near Naples, Marchesa Paulucci (Less. & Poll., op. cit.).

Var. **oretea** Less. & Poll., Monog. Limac. Ital., 1882, p. 56.

Amalia carinata var. *oretea* Less. & Poll., op. cit.

ANIMAL typical, but showing a longitudinal median black zone on the shield.

Sicily—Palermo, near stream Oreto, Marchesa Paulucci (Less. & Poll., op. cit.).

Var. **fuscocarinata** Cockerell, Nat. World, Sept. 1886, p. 179.

ANIMAL resembling type, but with the KEEL not differing in colour from the BODY.
Devon N.—Barnstaple, F. J. Partridge (W. E. Collinge, J. of Mal., Dec. 1898).
Middlesex—Bedford Park, Chiswick, Dec. 1884! T. D. A. Cockerell.
Warwick—Edgbaston, B. Peebles, recorded as *M. gagates* (J. of Mal., Dec. 1898).

Var. **rustica** Roebuck, Science Gossip, 1884, p. 78.

Amalia sowerbii var. *plumbea* Collinge, J. of Mal., Dec. 1898, p. 17.

ANIMAL bluish-grey in colour, without perceptible admixture of brown or yellow.

The sub-var. **plumbea** has the whole back and mantle of a dark lead-grey; slightly pale on sides of body; foot-sole ashy-grey.

Cornwall W.—Penmon near Falmouth, April 1884! H. Fox.
Devon N.—Sub-var. *plumbea*, Barnstaple, F. J. Partridge (Collinge, op. cit.).
Somerset S.—Bridgwater, Aug. 1884! W. Vinson.
Isle of Wight—Totlands Bay, Freshwater, June 1885! H. P. Fitzgerald.
Hants N.—Preston Candover, July 1885! H. P. Fitzgerald.
Kent E.—Faversham, Oct. 1884! E. B. Fairbrass.
Gloucester E.—Stroud, common, Oct. 1883! E. J. Elliott.
Suffolk E.—Woodbridge, June 1886! S. S. Pearce.
Pembroke—Near Pembroke, June 1885! Mrs. Trayler.
Cardigan—Aberayron, May 1888! W. Whitwell.
Louth—Piperstown near Drogheda, Oct. 1889! Miss S. Smith.
Dublin—Dublin, March 1886! J. R. Redding.

Var. **nigrescens** Cockerell, Nat. World, Sept. 1886, p. 179.

Amalia sowerbii var. *nigro-carinata* Collinge, J. of Mal., Dec. 1898, p. 17.

BODY dark-grey or nearly black; said to be often destitute of an internal shell.

The sub-var. **nigro-carinata** is very dark grey, with a deep black line running the whole length of the keel; foot-sole yellowish white.

Devon N.—Var. *nigrescens*, Barnstaple, and sub-var. *nigro-carinata*, Lynton, F. J. Partridge (W. E. Collinge, J. of Mal., Dec. 1898).
Hants N.—Var. *nigrescens*, Preston Candover, Oct. 1884! H. P. Fitzgerald.
Surrey—Var. *nigrescens* (T. D. A. Cockerell, op. cit.).
Middlesex—Var. *nigrescens*, Acton, Aug. 1884! and very common, Bedford Park, Chiswick, Feb. 1885! T. D. A. Cockerell.
Warwick—Var. *nigrescens*, garden, Edgbaston, B. Peebles, recorded as *Milax gagates* (J. of Mal., Dec. 1898, p. 18).
Pembroke—Var. *nigrescens*, Tenby, not uncommon with the type at Deer Park, and on the north cliffs (A. G. Stubbs, J. of Conch., July 1900).
Cardigan—Var. *nigrescens*, garden, Aberavron, May 1888! W. Whitwell.
Lancashire S.—Var. *nigrescens*, Knowsley, 1893 (Collinge, J. of Mal., June 1893).
Antrim—Var. *nigrescens*, Rathlin Island, May 1897, L. E. Adams.

Var. **bicolor** Cockerell, Science Gossip, Aug. 1887, p. 187.

Sides of BODY black; KEEL and SOLE orange coloured.

Devon N.—Barnstaple, F. J. Partridge (W. E. Collinge, op. cit.).
Middlesex—Ealing (T. D. A. Cockerell, op. cit.).

The **Geographical Distribution** of *M. sowerbii* is very similar to that of its congener, extending from the British Isles, along the west of France, into Spain and Portugal, thence it has been reported as *Milax carinatus* from several stations in the Mediterranean, and according to Jeffreys extends as far as Russia. In the British Isles it is distributed throughout England, Wales, and Ireland, but does not extend further north in Scotland than Fifeshire.

The uncertainty that prevails as to the exact limits of the specific line, however, renders our knowledge of its inhabited area uncertain; Dr. Scharff, from his observations of the living animal at Ems in Germany, was greatly struck by the manifest differences in aspect and habits of the Germanic *M. marginatus* from the British *M. sowerbii*: the former, which is probably a distinct species, having a light grey body, similar to that of *Arion circumscriptus*, with a keel still paler, while the mantle and body are speckled with minute black spots, and not lineolated as in *M. sowerbii*. It also prefers to live amongst stone rubble in mountainous districts, whilst our *M. sowerbii* shows a partiality for cultivated land.

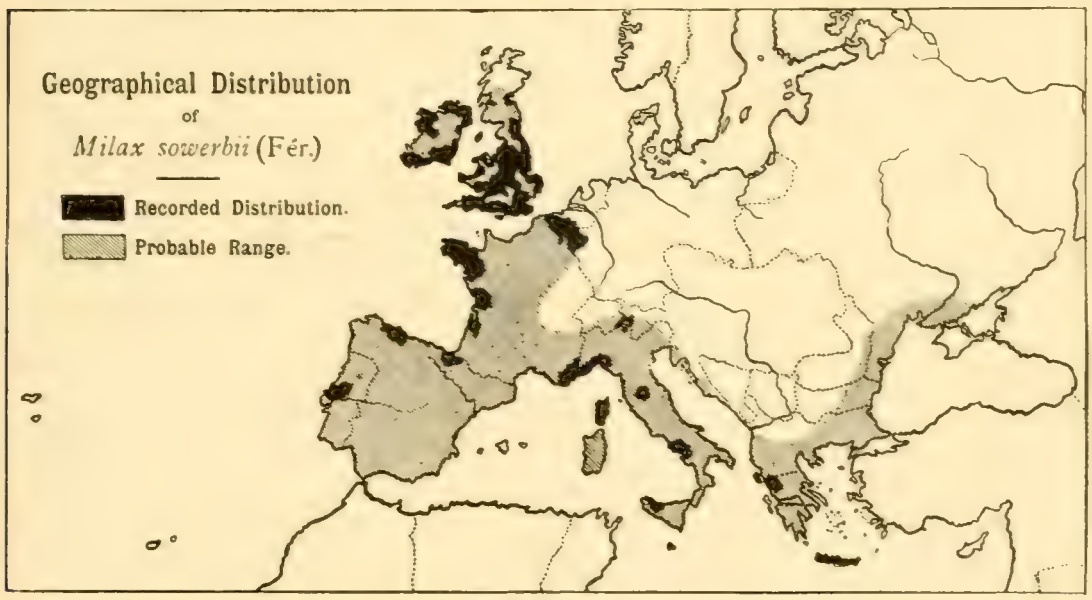


FIG. 179.

ENGLAND AND WALES.

Channel Isles—Generally distributed, common under stones in Guernsey, Sark, and Herm (Cooke & Gwatkin, Q. J. of C., 1878, p. 322). Jersey, Dr. Lukis (Ansted's Channel Isles, 1862). St. Sampson's, Guernsey, Sept. 1891 ! B. Tomlin.

PENINSULA.

Cornwall W.—Generally distributed (E. D. Marquand, Penzance Trans., 1884). Numerous about Truro, Dec. 1885 ! and at Newquay, Sept. 1886, J. H. James. Near Camborne (J. P. Johnson, Geol. Mag., Jan. 1903, p. 27).

Devon S.—Frequent in gardens about Exeter (E. Parfitt, Naturalist, 1854, p. 154). Torcross, Aug. 1885, F. G. Fenn. Torquay, April 1888 ! C. Ashford. Common in Mr. McMurdo's garden, Topsham, Aug. 1892, L. E. Adams.

Devon N.—Northam and Lynton, Nov. 1885 ! W. A. Gain. Common on east side of Hele Bay near Ilfracombe, March 1887 (B. Tomlin, J. of Conch., Apr. 1887). Barnstaple, 1898 (F. J. Partridge, J. of Mal., Dec. 1898).

Somerset S.—Abundant in the allotment gardens, near the canal and gasworks, Bridgwater, Aug. 1884 ! W. Vinson.

Somerset N.—Clevedon, in gardens, and in the copse between Upper Clevedon and the beach (A. M. Norman, Moll. Somerset, 1860). Bath, June 1884 ! C. J. Waterfall. Bitton and Mangotsfield, Feb. 1885, E. J. Lowe.

CHANNEL.

Dorset—Generally distributed (J. C. Mansel-Pleydell, Moll. Dorset, 1885). Chideock, Bridport, Aug. 1885 ! A. Belt. Portland, Aug. 1886 ! J. Madison.

Isle of Wight—Sandown, R. Gibbs (Forbes & Hanley, Brit. Moll., 1853, p. 289). Frequent at Bembridge, A. G. More ; and common about Ventnor, G. Guyon (Venables' Guide to Isle of Wight, 1860). Totlands Bay, June 1885 ! H. P. Fitzgerald.

Hants S.—Christchurch, common, Jan. 1883 ! Mudeford, Oct. 1879 ! C. Ashford. Portsdown Hill, May 1885 ! W. Jeffery.

Hants N.—Preston Candover, Nov. 1885 ! H. P. Fitzgerald.

Sussex W.—Not uncommon about Henfield, and at Hassock's Gate near Hurstpierpoint, W. Borrer (Harting, Zool., March 1878, p. 86). Not plentiful in gardens and about buildings, Ratham, Nov. 1886 ! W. Jeffery.

Sussex E.—Common on the Weald, and found also on the South Downs (Harting, Zool., March 1878, p. 86). Common in fields and gardens, Lewes and Battle, J. H. A. Jenner ; Ranscombe, C. H. Morris ; Eastbourne, E. A. Butler ; and Hastings, rare, Rev. E. N. Bloomfield (J. H. A. Jenner, Moll. East Sussex, 1885).

THAMES.

Kent W.—Common all along the Kentish marshes (A. J. Jenkins, Essex Nat., Nov. 1891, p. 230). Chislehurst, Sept. 1884 ! S. C. Cockerell. Abundant at Forest Hill, Sept. 1886 ! C. Oldham. Garden, Swan Hotel, Charing, Sept. 1891, L. E. Adams. Bromley, March 1885, T. D. A. Cockerell.

Kent E.—Walmer, 1897, H. Overton. Margate, April 1883, T. D. A. Cockerell. Faversham, Oct. 1884 ! Miss Fairbrass. Folkestone, abundant, Oct. 1886 ! C. Oldham.

Surrey—Lambeth, G. B. Sowerby (J. Denson, Loudon's Mag., Nov. 1832, p. 694). Reigate Hill (G. S. & E. Saunders, Reigate List, 1861). Battersea, Sept. 1884, T. D. A. Cockerell. Oxshott, May 1888 ! H. Wallis Kew. Commercial Docks, J. E. Daniel (T. D. A. Cockerell, Ann. and Mag. Nat. Hist., 1890, p. 284).

Essex S.—Not plentiful in fields and hedges at Barking Side, and in garden at Carswell (W. Crouch, Essex Nat., Dec. 1890, p. 208).

Herts.—Garden, Watford, Sept. 1884 ! J. Hopkinson. Ware, Dr. Jeffreys, and Verulam Hills (J. Hopkinson, Trans. Herts. Nat. Soc., July 1884).

Middlesex—Bayswater and Camden Town (J. Denson, Loudon's Mag. N.H., Nov. 1832). Hampstead (Brown, Illustr. Brit. Conch., 1845, p. 43). Foot of garden walls, Hampstead lane, Dec. 1888 ! and Highgate, June 1888 ! H. W. Kew. Gunnersbury, Dec. 1884 ! Acton, Dec. 1884 ! Bedford Park, Chiswick, Dec. 1884 ! and Regent's Park, T. D. A. Cockerell.

Oxford—Weston-on-the-Green, Rev. A. Matthews (A. M. Norman, Zool., 1857, p. 5610). Broughton ; in gardens at Kingham, S. Spencer Pearce ; and near Swincomb (W. E. Collinge, Conch., March 1891, p. 13).

ANGLIA.

Suffolk E.—Woodbridge, June 1886 ! S. Spencer Pearce. Mendlesham and Bramford (Mayfield, J. of Conch., April 1903, p. 295). Ipswich, 1893 (W. M. Webb, J. of Mal., 1893, p. 14).

Norfolk E.—Plentiful on stone banks, late in the evening, Catton and Thorpe (J. B. Bridgman, Zool., 1851, p. 3302). Norwich (Bellars, British Shells, 1858). Plentiful at Catton and Kirby Bedon ! (Mayfield, Trans. Norf. Soc., 1896, p. 185).

Norfolk W.—King's Lynn, 1884 ! C. B. Plowright ; July 1894 ! T. Petch.

Bedford—General Cemetery, Luton, April 1889 ! J. Saunders.

Northampton—Towcester, July 1881, A. Loydell. Peterborough, scarce, July 1882, A. W. Nicholls. Rockingham Park, May 1896, L. E. Adams.

SEVERN.

Gloucester E.—Common at Stroud, Oct. 1883 ! E. J. Elliott.

Gloucester W.—Clifton, Bristol (Rev. B. J. Clarke, Ann. and Mag. N.H., 1843, p. 339). Stroud, Oct. 1883 ! E. J. Elliott. Totshill and Dennil Hill, E. J. Lowe. Gardens, Bristol, June 1884 ! W. B. Waterfall.

Monmouth—Abundant at Chepstow, Portskewett, Tintern, Itton, St. Pierre, Usk, and Piercefield Park, also Shirenewton Hall, June 1886 ! E. J. Lowe.

Hereford—Orchard house in Hereford, Oct. 1886 ! C. B. Plowright.

Worcester—Yardley (G. S. Tye, Q.J. of Conch., May 1875). Nursery garden, Evesham, Nov. 1888 ! C. Ashford. Great Malvern, in cellar, July 1902 ! C. Waterfall.

Warwick—Stratford road, Camp Hill, Birmingham (G. S. Tye, Q.J. of Conch., May 1875). Garden, Edgbaston, Sept. 1898, Bromley Peebles.

Stafford—Very abundant in gardens of Old Hall, Stone, Aug. 1888 ! (J. R. B. Masefield, Staffordshire List, 1902).

SOUTH WALES.

Glamorgan—Near banks of River Taff, Llandaff, July 1885 ! and Cardiff, Oct. 1885 ! F. W. Wotton. Common about Swansea, 1901, H. Rowland Wakefield.

Pembroke—Pembroke, June 1885 ! Mrs. Trayler. Common, very variable in colour, and often very large about Tenby; the North Cliff specimens have very thick shells (A. G. Stubbs, J. of Conch., July 1900).

Cardigan—Common in garden, Aberayron, May 1888 ! Miss Maddy. Aberystwith, May 1888 ! E. Collier.

NORTH WALES.

Carnarvon !—T. Shankland (J. of Conch., 1891, p. 398).

Denbigh—Great Orme's Head, Jan. 1888 ! Lionel E. Adams.

TRENT.

Lincoln S.—Near Boston, Sept. 1884 ! W. Denison Roebuck.

Lincoln N.—Louth, May 1886 ! H. Wallis Kew.

Leicester—Near gardens, London road, Leicester, Sept. 1886 ! H. E. Quilter.

Notts.—Highfield House near Beeston (Lowe & Musson, Mid. Nat., Aug. 1879).

Derby—Repton, 1885, Rev. H. Milnes. Mansfield, 1881, E. Pickard.

MERSEY.

Cheshire—Near Jackson's Boat (J. Hardy, Manchester List, 1865). Chester (Tate, Brit. Moll., 1866, p. 81). Garden, Baguley road, Sale, Oct. 1892 ! C. Oldham.

Lancashire S.—Botanical Gardens, Manchester (J. Hardy, op. cit.). Hesketh Park, Southport, 1889 (W. H. Heathcote, Conch., June 1891). Banks of Leeds and Liverpool Canal, by the bridge at Lydiate, G. W. Chaster (J. W. Williams, Conch., March 1891). Knowsley near Liverpool, 1893 (W. E. Collinge, J. of Mal., June 1893).

Lancashire Mid—Catteral near Garstang, Sept. 1888 ! and Preston, Sept. 1890 ! W. H. Heathcote.

HUMBER.

York S.E.—In gardens, Hull (J. D. Butterell, Nat., Dec. 1878, p. 71).

York N.E.—Spa grounds, Scarborough, 1885, E. J. Lowe. Common in garden, Scarborough, April 1888 ! C. Ashford. Plentiful near Whitby, Aug. 1883 ! H. Pollard. Abundant in garden, Borough road, Middlesbrough, Sept. 1886 ! T. A. Lofthouse.

York S.W.—Bretton and Haw Park, 1883, J. Wilcock. Ackworth (C. Ashford, Zool., 1854, p. 4261).

York Mid W.—Meanwood near Leeds, Aug. 1882 ! W. Denison Roebuck. Killinghall, July 1882 ! W. Nelson. Pateley Bridge, Aug. 1882 ! W. Storey. Ingleton district (W. E. Collinge, Naturalist, April 1890).

TYNE.

Durham—South Shields, specimens in British Museum from R. Howse.

Northumberland S.—Near Benwell, W. Backhouse (J. Alder, Northumb. and Durham List, 1848). Museum grounds, Newcastle-on-Tyne, Aug. 1888 ! R. Howse.

LAKES.

Isle of Man—Near the Nunnery, Douglas, July 1880 ! W. Nelson. At entrance to Glen Meay, Sept. 1891 !

SCOTLAND. *WEST LOWLANDS.*

Renfrew—Frequent in gardens, Greenock, Sept. 1886 ! T. Scott.

EAST LOWLANDS.

Edinburgh—Warriston Cemetery, Edinburgh, June 1901, R. Godfrey. Meggatland near Edinburgh ! Morningside ! and Craiglockhart, Oct. 1899 ! W. Evans.

EAST HIGHLANDS.

Fife and Kinross—North Queensferry, Aug. 1886 ! W. Denison Roebuck.

WEST HIGHLANDS.

Clyde Isles—Common about Aquarium, Rothesay, Bute, Nov. 1886 ! T. Scott.

NORTH HIGHLANDS.

Sutherland E.—Introduced at Brora, but has apparently now disappeared (W. Baillie, J. of Conch., Jan. 1889).

IRELAND. *ULSTER.*

Derry—Near Londonderry, J. N. Milne (R. F. Scharff, Irish List, 1892). Plentiful on railway bank opposite Downhill Station, Feb 1900, R. Welch.

Donegal—Above Rosapenna, May 1902, R. Welch.

Antrim—Cushendun, May 1886 ! S. A. Brenan. Common on Rathlin Island, L. E. Adams. Brown's Bay, July 1899, R. Welch.

Down—Downpatrick, Oct. 1897, R. Welch.

LEINSTER.

Louth—Piperstown, Jan. 1890 ! Miss Sidney Smith.

Dublin—Ditches by Circular road, near Phœnix Park, Dublin, R. Ball (B. J. Clarke, Ann. and Mag. Nat. Hist., Nov. 1843). Damp gardens at Monkstown and Killiney (W. W. Walpole, Zool., 1853, p. 4022). Garden of Sloperton Lodge, March 1886 ; Kill of the Grange, April 1886 ! and Kingstown, June 1886 ! W. F. de Vismes Kane. Field at Finglas, May 1886 ! J. R. Redding. Howth, April 1887 !

Whitechurch, Oct. 1890; Raheny, Aug. 1890; and garden, Tudor House, Leeson Park, Dublin, Oct. 1890! R. F. Scharff. Donnybrook, Aug. 1888! G. Barrett-Hamilton. Abundant in marsh, Bushy Park; and in garden, Zion road, Rathgar, Sept. 1903, A. W. Stelfox and R. Welch. Drain at Dundrum, Oct. 1899, R. Welch.

Wicklow—Woodenbridge, March 1893 (R. F. Scharff, Irish Nat., April 1893). Kilruddery; Glen of Downs; Sugar Loaf and Albidore Glen, July 1891, R. F. Scharff.

Wexford—Alderton, New Ross, Sept. 1888! Miss L. Glascott. Wexford, April 1891, R. F. Scharff. Rosselare sandbank, Sept. 1889! G. Barrett-Hamilton.

Carlow—Carlow, Nov. 1901, A. G. Stuart.

Kilkenny—Tabulated by Mr. L. E. Adams (J. of Conch., Oct. 1892, p. 234).

CONNAUGHT.

Sligo—Woods at Moyview, Ballina (Miss Amy Warren, Zool., Jan. 1879). Inishmurry Island, Sept. 1900, R. Welch.

Mayo W.—Dugort, Sept. 1888! (J. G. Milne, J. of Conch., Oct. 1891).

Galway E.—Monivea (B. J. Clarke, Ann. and Mag. Nat. Hist., 1840). Several in graveyard, Clare-Galway Abbey, July 1895, R. Standen. Leenane Mountain and Dernasliggan, April 1897, R. Welch, Irish Nat., Nov. 1897.

Galway W.—Aran Isles, Oct. 1890, R. F. Scharff.

MUNSTER.

Tipperary S.—Near Clonmel, Dec. 1885, A. H. Delap.

Waterford—Waterford, Sep. 1883! J. H. Salter. Clonmel, Apl. 1888, A. H. Delap.

Cork N.—Youghal (R. Tate, Brit. Moll., 1866, p. 81). Queenstown, R. F. Scharff. Abundant in woods around Blarney Castle, Sept. 1898, L. E. Adams.

Cork S.—In gardens of Royal Cork Institution (Humphreys, Fauna and Flora of Cork, 1845, p. 2). Glengariff, May 1891, R F. Scharff. Common about Bantry, Sept. 1898, L. E. Adams.

Kerry—Near the Southern Hotel, Kenmare, July 1898 (R. Standen, Irish Nat., Sept. 1898). Valentia Island, April 1888, A. H. Delap.

GERMANY.

Dr. Jeffreys records *M. sowerbii* from Falkenstein in the Upper Harz, but it is doubtful if this record really refers to our species. Mr. Daniel also records from Heidelberg as *L. carinatus* a slug described as darker and more distinctly spotted than English specimens, probably a dark variety of the *Milax marginatus*.

NETHERLANDS.

Belgium—*M. sowerbii* (Kickx, Nachr. Deutsch. Mal. Ges., 1869, p. 163).

FRANCE.

M. sowerbii inhabits the Atlantic shores of France, the departments Côtes-du-Nord, Finistère, Gironde, Morbihan, and Vendée being especially noted, while as *M. carinatus* it is known for the Alpes Maritimes and the Var. Signor Pollonera notes it as living about Bastia, Corsica, whilst Gassies under the name of *Limax argillaceus* records it for the Gironde.

SWITZERLAND.

The specimens found plentifully at an altitude of 2,600 feet at Promontogno and Bondo in the Bergel Valley, Grisons, by the Rev. S. Spencer Pearce were regarded by him as identical with the British form.

ITALY.

Milax sowerbii is recorded from Florence in Tuscany by Dr. Simroth. Lessona and Pollonera give the distribution of *M. carinatus* as extending over Liguria, Tuscany, Naples, and Sicily, but as being an absentee from the Adriatic shores of Northern Italy and Sardinia, and Pollonera describes it as common at Malta.

SPAIN AND PORTUGAL.

Spain—*M. sowerbii*, shores of northern Spain (Bourguignat, Mal. Alger., 1864, p. 46). Lascalles, Reinosa, and Hoy de Barcena in the Asturias, and in the spurs of the Pyrenees, May 1860, E. J. Lowe.

Portugal—*M. carinatus* (Scharff, Irish List, 1892).

BALKAN PENINSULA.

Greece—Megalopolis, Oct. 1891! J. G. Milne. *M. hessei*, Prevesa in Epirus and Gasturi in the Island of Corfu (Böttger, Nachr. Deutsch. Mal. Ges., 1882, p. 96).

Crete—*M. carinatus* (Kobelt, Zoogeogr., 1898, p. 324).

RUSSIA.

Dr. Jeffreys cites Russia for our species on the authority of Jelski.

NEOTROPICAL REGION.

Ecuador—A specimen in the British Museum, collected by Mr. Buckley, differs in nothing from those found near London (Cockerell, Ann. and Mag. N. H., Oct. 1890).

Distribution of *Milax sowerbii* (Fér.)

In the Counties and Vice-Counties of the British Isles.

ENGLAND AND WALES.

Channel Isles

PENINSULA
1 Cornwall W.
2 Cornwall E.
3 Devon S.
4 Devon N.
5 Somerset S.
6 Somerset N.

CHANNEL
7 Wilts N.
8 Wilts S.
9 Dorset
10 Isle of Wight
11 Hants S.
12 Hants N.
13 Sussex W.
14 Sussex E.

THAMES
15 Kent E.
16 Kent W.
17 Surrey
18 Essex S.
19 Essex N.
20 Herts.
21 Middlesex
22 Berks.
23 Oxford
24 Bucks.

ANGLIA
25 Suffolk E.
26 Suffolk W.
27 Norfolk E.
28 Norfolk W.
29 Cambridge
30 Bedford
31 Hunts.
32 Northampton

SEVERN
33 Gloucester E.
34 Gloucester W.
35 Monmouth
36 Hereford
37 Worcester
38 Warwick
39 Stafford
40 Salop

SOUTH WALES
41 Glamorgan
42 Brecon
43 Radnor
44 Carmarthen
45 Pembroke
46 Cardigan

NORTH WALES
47 Montgomery
48 Merioneth
49 Carnarvon
50 Denbigh
51 Flint
52 Anglesey

TRENT
53 Lincoln S.
54 Lincoln N.
55 Leic. & Rutld.
56 Notts.
57 Derby

MERSEY
58 Cheshire
59 Lancashire S.
60 Lancashire Mid

HUMBER
61 S.E. York
62 N.E. York
63 S.W. York
64 Mid W. York
65 N.W. York

TYNE
66 Durham
67 Northumb. S.
68 Cheviotland

LAKES
69 Westmorland and L. Lancs.
70 Cumberland
71 Isle of Man

SCOTLAND.

W. LOWLANDS
72 Dumfries
73 Kirkcudbright
74 Wigtown
75 Ayr
76 Renfrew
77 Lanark

E. LOWLANDS
78 Peebles
79 Selkirk
80 Roxburgh
81 Berwick
82 Haddington
83 Edinburgh
84 Linlithgow

E. HIGHLANDS
85 Fife & Kinross
86 Stirling
87 Perth S. & Clkn
88 Mid Perth
89 Perth N.
90 Forfar
91 Kincardine
92 Aberdeen S.

E. HIGHLANDS
93 Aberdeen N.
94 Banff
95 Elgin
96 Easterness

W. HIGHLANDS
97 Westerness
98 Main Argyle
99 Dumbarton
100 Clyde Isles
101 Cantire
102 Ebudes S.
103 Ebudes Mid
104 Ebudes N.

N. HIGHLANDS
105 Ross W.
106 Ross E.
107 Sutherland E.
108 Sutherland W.
109 Caithness

NORTH ISLES
110 Hebrides
111 Orkneys
112 Shetlands

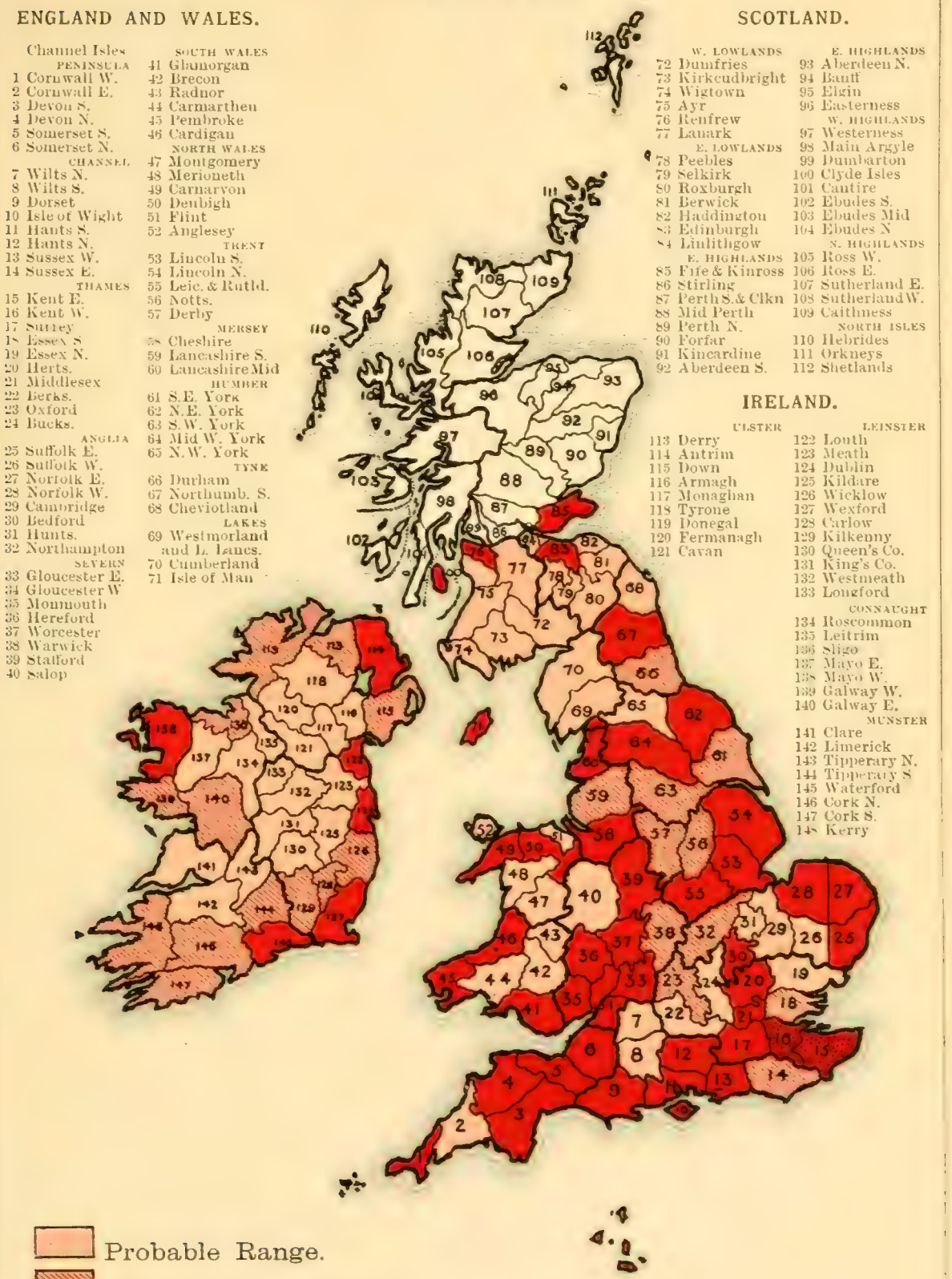
IRELAND.

ULSTER
113 Derry
114 Antrim
115 Down
116 Armagh
117 Monaghan
118 Tyrone
119 Donegal
120 Fermanagh
121 Cavan

LEINSTER
122 Louth
123 Meath
124 Dublin
125 Kildare
126 Wicklow
127 Wexford
128 Carlow
129 Kilkenny
130 Queen's Co.
131 King's Co.
132 Westmeath
133 Longford

CONNAUGHT
134 Roscommon
135 Leitrim
136 Sligo
137 Mayo E.
138 Mayo W.
139 Galway W.
140 Galway E.

MUNSTER
141 Clare
142 Limerick
143 Tipperary N.
144 Tipperary S.
145 Waterford
146 Cork N.
147 Cork S.
148 Kerry



Probable Range.

Recorded Distribution.

Distribution verified by the Authors.

Fossil Distribution.

acl2.27

MONOGRAPH
OF THE
LAND & FRESHWATER MOLLUSCA
OF THE
BRITISH ISLES.

JOHN W. TAYLOR.

Smithsonian Institution
MAY 27 1907
192703

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FOSSIL SPECIES.

Limax modioliformis Sandberger.

Limax modioliformis Sandberger, Palæontographica, 1880, p. 113, pl. xii., f. 15.

SHELL transparent or diaphanous, but thick in substance, somewhat ovoid and bearing a certain resemblance to the valve of a small *Modiola*; APEX or nucleus terminal and placed towards the left corner; UPPER SIDE, especially in aged specimens, more or less strongly wrinkled, with the concentric lines of growth, between which dark arborescent markings can be detected; UNDER SIDE rugosely granulate.

Length, 5 mill.; breadth, 3·5 mill.

FIG. 180. — *Limax modioliformis* Sandberger, enlarged (after Sandberger).

This species, which was found in some numbers by Mr. Clement Reid, has, according to Sandberger, some affinity in form with the *Limax crassitesta* of Reuss, from the Lower Miocene of North Bohemia. Dr. Böttger and Mr. Heynemann are quite in accord in being unable to identify this shell with that of any recent species, although Bronn has suggested a similarity in structure to the shell of *Limax arborum*, which is also found in the same beds.

BRITISH ISLES.

Lower Pleistocene—West Runton, East Norfolk, Clement Reid (Sandberger, op. cit.).

Limax latus (Edwards).

Ancylus? **latus** F. E. Edwards, Monog. Eoc. Moll., 1852, p. 110, pl. xiv., f. 15.
Limax *latus* Cockerell, Conch., Sept. 1893, p. 174.

SHELL broadly sub-conical, somewhat incrassate, and greatly depressed, with the vertex or nucleus about half-way between the margin and the middle.

Length, about 6½ mill.; breadth, about 5 mill.

FIG. 181. — *Limax latus* (Edw.), enlarged (after Edwards).

This species, of which only an imperfect specimen was known to Mr. Edwards, was characterized by him, though with considerable doubt and hesitation, as an *Ancylus*; it, however, proves to be, according to Woodward's Manual,[1] really the shell of a *Limax*.

Mr. Edwards described the shell as distorted at the posterior extremity, and as presenting the appearance of a sinus, somewhat resembling, though in an exaggerated form, that presented by the shells of the *Limacina*. This sinus, or indentation, he believed was probably due to the accident which produced the distortion.

BRITISH ISLES.

Oligocene—Recorded for Sconce, near Bembridge, in the Isle of Wight, by Edwards, and according to Mr. Ashford, has also been found in the Headon Beds at Headon Hill, in the Isle of Wight, and at Hordwell in South Hants.

1 Woodward's Manual of the Mollusca, 1875, p. 296.

FAMILY ARIONIDÆ Gray.

Carlo Pollonera

The family *Arionidæ*, according to Pilsbry, is somewhat discontinuous in its geographical range, occupying three widely separated areas, in each of which a predominant type occurs.

The West American area has the greatest number and variety of genera, embracing the *Binneyinæ*, *Ariolimacinæ*, etc., and forming the most primitive group of the family; one form, *Binneya*, possessing a spiral external shell with sculptured nepionic whorl, short body cavity, and solid tail, may be regarded as linking *Arionidæ* with the *Endodontidæ*, from which they are supposed to have been derived.

The Asiatic centre is concentrated in the Himalayas, and represented by *Anadenus*, a group in which the caudal gland is wanting and the male intromittent organ still present, undoubtedly representing in these respects the most ancient form of the group. It is most closely allied to the genus *Prophysaon*, but in the penial development shows nearest affinity to *Hesperarion*, both of which are now West American groups.

The true *Arions*, the most highly developed forms, have their home in the European region, the probable source of origin of the entire group, from whence in past ages the earlier and more primitive genera have spread throughout the northern hemisphere, the most simply-organized groups, as is usual, occupying the regions most remote from their place of origin, and not, as is too prevalently believed, persisting in their evolutionary centre. The *Arions* are remarkable for the peculiar penial degeneration they have undergone, and the assumption of the intromittent function of that organ by the oviducal passage.

The *Arionidæ* are not descended directly from the primitively shell-less forms, as has been averred, but unmistakeably show their descent from a group with well-developed spiral shells, the American forms supplying the chief links which make plain the progress of the modifications and clearly demonstrate that the typical genus *Arion* is the terminal member of a series of forms beginning with *Binneya*, half-slug and half-snail with almost helicoid musculature, and passing by numerous intermediate stages still existing to the typical *Arion* organization.

The family is probably most satisfactorily divided by utilizing the various modifications of the free-retractor muscles, their arrangement showing also the weightiest differences between the *Arionidæ* and other slugs.

With this group Signor Carlo Pollonera, of Turin, is here associated in cordial recognition of the extent and importance of his researches upon the organization, specific differentiation, and classification of the *Arionidæ* and of the slugs generally.

In the British Isles the family is represented by only two genera, *Arion* and *Geomalacus*, the remaining and more ancient groups being now restricted to the remoter parts of the northern hemisphere.

Genus *ARION* Férussac.[1]

The genus *Arion* is dedicated to Mr. W. Denison Roebuck, F.L.S., of Leeds, whose knowledge of the external morphology of the British slugs is probably unsurpassed, and whose tireless exertions have so immensely extended our knowledge of the variation and distribution of our native species.

The *Arions* (αριων, the name of a mythological musician and poet, or according to some authorities a mythological horse famous for its speed) were first imperfectly separated from *Limax* by Brard, in 1815, who retained the term *Limax* for the group now called *Arion*, and constituted the genus *Limacella* for the shell only, as distinguished from the animal, of the species we now regard as the true *Limaces*, basing this separation upon the possession of a distinct shell in *Limax*, and the presence of a few chalky granules only in *Arion*. Baron Férussac also separated the genera, using the terms *Arion* and *Limax* to distinguish the groups, and basing the separation upon the presence or absence of the caudal gland.

The *Arions* have been variously divided, Moquin-Tandon using the degree of firmness and coherence of the lime particles representing the shell, as the basis for his groups *Lochea* and *Prolepis*, while Mabille and Seibert distinguish sections by the terms *Baudonia*, *Kobeltia*, and *Carinella*. Dr. Simroth utilizes the modifications of the atrium, forming the groups *Monatriida* and *Diatriida*, according as the vestibule remains simple or develops a secondary enlargement originating at the free oviduct. Signor Pollonera has, however, pointed out how unstable this character is, and instances *Arion hortensis* as a species in which the change from a monatriid to a diatriid condition can be easily traced in passing from France to Germany.

The *Monatriidæ*, represented by *Arion minimus*, *A. subfuscus*, and *A. circumscriptus*, are said by Simroth to be characterized externally by a distinct band on each side of the body, while in the *Diatriidæ*, represented by *Arion ater* and *A. hortensis*, the band shades away outwardly; this difference is, however, not so markedly observable in British specimens, but in both groups there is a general tendency to become unicolorous and render this difference obscure and unrecognizable.

The *Arions* are unquestionably a closely-allied group, in which it is extremely unsafe to establish new species upon examples in alcohol or other preservatives, and in which it is necessary to study the characters exhibited by the living animal in order to arrive at sound conclusions, as the internal characters of even our good and undoubted species present a strong family likeness, and the differences are not always very decided,

needing at times to be supplemented by a study of the external features of the animal. Even Dr. Simroth, whose profound knowledge of the organization of the *Arions* is incontestable, feels compelled to remark "that the species of the genus *Arion* are so difficult to distinguish anatomically, that they can only be determined with certainty by the aid of their colouring." It is, therefore, to be regretted that, in view of this almost too closely intimate relationship, so many so-called new species have been described, and that painstaking naturalists of our own country have been found to emulate in this respect the more objectionable methods of the few continental extremists.

Generic Characteristics.—EXTERNALLY, the features of the *Arions* when adult are a rounded DORSUM and a somewhat corpulent BODY; rugose SKIN; an uncarinated and blunt TAIL; FOOT with distinct pedal-groove meeting over a caudal mucus pore; MANTLE or shield granulate, rounded at each end, and placed at the anterior end of the body, with the RESPIRATORY APERTURE near its right anterior end, and the GENITAL ORIFICE beneath.

According to Simroth, they originally possessed an ancestral lateral band at each side, coincident in position with the longitudinal lateral blood sinuses, but in the more advanced forms this peculiarity becomes obscured.

The SHELL is represented by a soft and pulpy calcareous secretion, which solidifies upon exposure to the air, and also to some extent by age; it is placed beneath the hinder part of the mantle, and according to Lankester, is within a permanently-closed sac, and represents the primitive shell.

INTERNALLY, the group is characterized by the crowding of the main mass of the genitalia into the anterior half of the body, and the absence of the penis, the intromittent functions of which organ have been usurped by the vagina. It is also remarkable for the opaque-white colour of the walls of the arterial vessels, especially those investing the digestive gland and the alimentary canal, their complex ramifications showing out beautifully against the darker background. This whiteness is due to a dense deposit of fat and lime within the cells of the arterial sheath, a deposit regarded by Semper as a temporary storehouse of lime for subsequent use in the body.

The NERVOUS SYSTEM is remarkable for the distribution of the dorsal nerve, which becomes bifid apparently in correlation with the separation of the TENTACULAR RETRACTORS with which they are in association.

The ALIMENTARY CANAL is more or less spirally triodromous, the coil being held in position anteriorly by the AORTA, as is usual, and the STOMACH TRACT being the most posteriorly extended; the JAW is odontognathous[1] or ribbed; and the teeth of the RADULA cuspidate, with quadrate base of attachment.

The MUSCULAR SYSTEM is quite different from that displayed by *Limax* and by the *Helicidæ*, in which the tentacular and pharyngeal muscles unite posteriorly into a single band or possess a common base of attachment, whereas in *Arion* the pharyngeal as well as each tentacular muscle have their separate and widely-distant places of attachment to the dorsal skin, and constitute the section Trichoriza.[2] This separation of the tentacular retractors is probably due to mechanical causes, the oblique strain tending to pull apart the muscles, and as the soft degenerate shell no longer affords a firm attachment, the retractors have become fixed to the tough dorsal integument or to the lung floor.

1 Monog. i., p. 254, f. 509. 2 Monog. i., p. 344, f. 638.

The REPRODUCTIVE ORGANS are comparatively simple, and triaulic, the EPIPHALLUS, OVIDUCT, and SPERMATHECA all opening into what has been termed the upper vestibule or EGG-SAC, which is formed by an expansion of the free-oviduct, and according to Dr. Babor, becomes most marked when the animal is in the male phase of its development: the PENIS is aborted, and the FLAGELLUM, DART-SAC, digitate VAGINAL GLANDS, and copulatory branch of the spermatheca are absent; the OVOTESTIS is placed quite at the rear of the body, while the prostate or SPERM-DUCT is also not a closed tube, as in *Limax*, but is open laterally and communicates throughout its length with the oviduct.

The SUPRA-PEDAL GLAND is not imbedded in the pedal musculature, but lies free upon the foot, and extends about half the total length of the body; but in addition to the dermal and locomotory mucosity, the *Arions* produce a very gelatinous mucus with great rapidity at the caudal sinus, which at pairing time becomes very abundant, and which is slowly devoured by the prospective partner during the preliminary circular promenade.

Reproduction and Development.—The congress of the species of this genus is preceded by the prolonged circular procession and many of the amatory dallyings described under the *Limacidæ*; the normal intromittent organ has, however, become aborted, and the union is now effected by the eversion of the oviduct, powerful retractor muscles being developed for the withdrawal of the organ into the body when the union has been consummated, the seminal element being transferred by means of an elongate and multidenticulate spermatophore, which, though quite pliable when fresh, becomes hardened by exposure to the air; it, however, speedily disintegrates or dissolves when lodged in the spermatheca.

The duration of life is probably usually about one year, but in the west of Ireland and other mild localities this period may be prolonged to even double that time. This restriction of the age attained is perhaps in part explainable by the absence of an external shell, which would materially aid them to endure hot, cold, and more especially dry seasons.

Food and Habits.—The *Arions* have the same crepuscular and nocturnal habits which so markedly characterize the *Limacidæ*, hiding away beneath rubbish, stones, logs, etc., or burrowing into the earth for concealment during the day, and only appearing at sunset to enter upon their foraging expeditions, except during very cloudy or showery weather, when they may be frequently seen crawling about during the day.

They are very slow and sluggish in their movements, but when young are adepts in slime-spinning, *Arion subfuscus* being exceptionally noticeable for the facility and readiness with which it makes use of this means of escape from a disagreeable or undesirable situation. The slugs, and especially the *Arions*, do not, however, seem to possess the same recuperative power as the testaceous species, a comparatively slight injury nearly always proving fatal in its effects.

The *Arions* are very voracious, especially in early spring, when they eat ravenously, devouring almost any animal or vegetable substances, fresh or decaying, that they meet with; they are not only carnivorous and cannibalistic but often coprophagous.

Fossil.—A species attributed to *Arion*, the *indifferens* of Boettger, has been found in the Lower Miocene of Niederrad, near Frankfort-am-Main, but no traces of the genus have been met with in this country lower than the Pleistocene beds.

Variation.—In *Arion* the pigmentation has resolved itself into two chief colours : one dusky or black producing the markings, and the other various shades of red, both of which in the larger and more variable species by their development or degeneration quickly show, especially during the growth period, the effects of varied environment, mirroring back in the slug's body the effect of climate, etc. Cold and moisture being favourable to the development of the dusky pigment and warmth and dryness to the red.

The darker varieties are found most numerously in the northern regions and in mountainous districts, and this melanic tendency is correlated with a stouter and coarser condition of the skin, and by a bolder tuberculation, while the brighter coloured forms are probably the outcome of a dry and warm environment, and though these factors are not the only ones that foster a brilliancy of colouring or the reverse, yet they undoubtedly have a very marked influence thereon.

The largest and most advanced species are those most actively engaged in the elaboration of new forms, but it is amongst the smaller and more primitive species that convergence is most evident, and which display most strikingly their common relationship to an ancestral form.

Geographical Distribution.—The *Arions* are European in origin and distribution, affecting more particularly the western area ; members of the group have, however, spread into Siberia, North Africa, Azores, Madeira, etc., and through the agency of commerce have secured a footing in North America and other places.

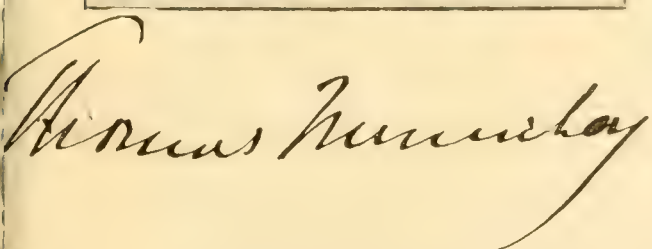
It has, however, been erroneously supposed by Bourguignat and other able scientists that *Arion*, as well as other genera, originated on the Central Asian plateau, and spread into Europe by way of the great northern coniferous belt, or along the mountain chains of Central Europe, while other modern authors believe the Iberian peninsula or the lost Atlantis to be the true birthplace of the group.

Fig. 184.—A Malacological Laboratory.
Mr. W. E. Collinge at the University, Birmingham.

Arion ater (L.).

1606 *Cochlea nuda tertia tota nigra* Aldrovandus, de Insectis, lib. 3, cap. 10.
1678 *Limax ater* Lister, Hist. Anim. Angl., p. 131, pl. 2, f. 17, tit. xvii.
1682 *Limax major rubicunda terrestris*, Muralto Miscell. cur. obs. 59, p. 147.
1763 *Limax albus margine luteo* Müller, Swamp. Hafn., p. 61.

1758 *Limax* **ater** L., Syst. Nat., ed. x., vol. i., p. 652, no. 1.
1758 — *rufus* L., op. cit., no. 2.
1767 — *albus* L., op. cit., ed. xii., vol. i., p. 1081.
1774 — *succineus* Müller, Verm. Hist., no. 203, p. 7.
1789 — *luteus* Razoumowsky, Hist. Nat. Jorat, i., p. 268.
1803 — *marginellus* Schranck, Fauna Boïca Würmer, p. 252, no. 3158.
1848 — *coccineus* Gistel, Naturg. d. Thierreichs.
1819 **Arion** *empiricorum* Férussac, Hist. Moll., p. 60, pls. 1, 2.
1821 — *melanocephalus* Férussac, Tabl. Syst., p. 18.
1845 — *sulcatus* Morelet, Moll. Port., p. 28, pl. 1.
1854 — *virescens* Millet, Moll. Maine et Loire, p. 11.
1854 — *tenellus* Millet, op. cit.
1855 — (*Lochea*) *rufus* Moq.-Tand., Hist. Moll. France, ii., pp. 10, 13, pl. 1, f. 1-27.
1867 — *glaucus* Colbeau, Ann. Soc. Mal. Belg.
1868 — *hibernus* Mabille, Rev. et Mag. Zool., xx., p. 134.
1870 — *servainianus* Mabille, Hist. Mal. bass. Paris, p. 8.
1888 — *bocagei* Simroth, Zool. Anz., no. 272.
1878 *Lochea atra* Malm, Skand. Land Snigl., p. 31, pl. 1, f. 1.



HISTORY.—*Arion ater* (*ater*, black), is the largest of our native species, and was first made known by Dr. Martin Lister, in 1674, under the descriptive epithet of *Limax ater*, and he afterwards, in 1678, gave a good figure in Hist. Anim. Angl.; considerable confusion and uncertainty has, however, arisen owing to the wide range of colour mutations to which it is subject, and many species have been created to receive them.

The name *empiricorum* (in allusion to its former use in medicine), bestowed on this species by Baron Férussac, was intended not to separate any particular form, but to unite under one denomination all the different varieties and so-called species into which this protean slug had been divided. It has in other parts of its range also received many distinct names, based upon the slight external modifications it has undergone.

With this species is associated the late Mr. Thomas Nunneley, F.R.C.S., of Leeds, whose careful and conscientious memoir of 1837 upon the anatomy of the present and three other species was one of the precursors of the modern scientific study of slugs, and it is to be regretted that his professional career as a distinguished and skilful surgeon did not leave him leisure to follow up his anatomical studies of the mollusca.

Diagnosis.—*Arion ater* may be distinguished when adult by its large size, long and coarse tubercules, and usually uniform colouration, as well as by the very contracted and hemispherical shape it assumes when at rest and particularly when alarmed or irritated, a position often accompanied by a very peculiar swaying or elephantine motion of the body.

INTERNALLY, this species is perhaps best distinguished from its congeners by the greatly enlarged and protuberant base of the oviduct.

Description.—ANIMAL usually black or brown in this country, but varying marvellously in its colouring; of great size, sometimes reaching 200 mill. in length when extended, very bulky and convex above, and terminating behind in a flattened TAIL, bearing a distinct triangular GLAND; when contracted the animal assumes a very characteristic hemispherical shape; TUBERCLES very long and prominent, becoming keeled and transversely wrinkled during contraction, and showing about eighteen longitudinal rows at each side; FOOT-SOLE obscurely tripartite, but median portion not separated by a furrow from the side-areas, which are usually pervaded by the body colour; the FOOT-FRINGE is broad, widest at the tail, spread out when the animal is at rest, and presenting a series of transverse parallel lineoles, of which every alternate one is darker; in strongly coloured individuals these lines are continued across the side-areas of the sole; SHIELD ovoid, narrow in front, with small

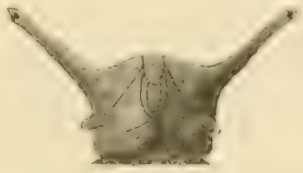


FIG. 186.—Head of *Arion ater*, showing the facial grooves.

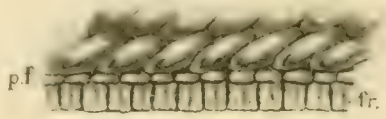


FIG. 187.—Foot-fringe and pedal-groove of *Arion ater* × 2.
p.f. pedal furrow; *fr.* fringe.

vermicular rugosities, which may coalesce into irregular and limited wavy lines, not unlike the ridges of *Limax*; RESPIRATORY ORIFICE large and round, situate on the right side of the body, near the anterior third of the length of the shield, its lower margin cut by the anal channel; HEAD usually darker than the rest of the body, with four dorsal furrows, the outer ones terminating at the ommatophores, but the median pair become quadripartite on the forehead and vary greatly in shape when the mouth is in motion; OMMATOPHORES dusky, tubercled, rather swollen at the apex; lower TENTACLES also dusky and finely granulate.

MUCUS very tenacious and variable in colour; when the animal is scalded it is usually orange-coloured in red animals, in black animals usually colourless or milky-white. The mucus secreted by the caudal gland is ropy and clear yellowish.

SHELL quite vestigial, and generally represented by a soft and pulpy calcareous deposit placed beneath the hinder part of the shield; it is, however, sometimes more concentrated and becomes hardened into a granular form, with the particles more or less coherent. In the chalk-pits about Dorking Mr. Darbishire has observed that all the animals contain thick and solid shelly masses.

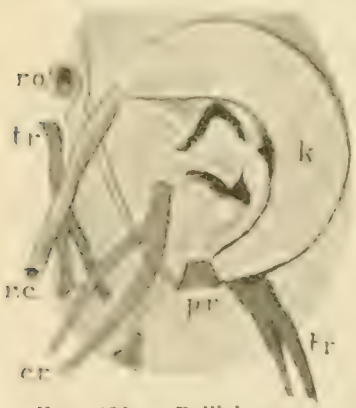


FIG. 188. — Pallial organs of *Arion ater*, as seen from below × 2 (after Godwin-Austen). *c.r.* cephalic retractor; *t.r.* tentacular retractors; *p.r.* genital retractor, cut short; *k.* kidney, enclosing heart; *rc.* rectum; *r.o.* respiratory orifice.

FIG. 189.

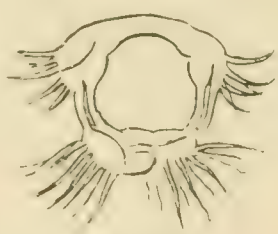


FIG. 190.

FIG. 189.—Heart of *Arion ater* × 3. *au.* auricle; *v.* ventricle.
FIG. 190.—Nerve-ring of *A. ater* v. *rufa* (after Moquin-Tandon).

INTERNALLY, the body cavity is pale and closely beset with minute calcareous particles; the buccal ganglia are oval; the HEART is surrounded by the KIDNEY, the auricle is broadly united to the ventricle, and directed towards the anterior left side of the BODY; RESPIRATORY ORIFICE ample, allowing the complex and prominent respiratory vessels to be perceptible through the opening.

The CEPHALIC RETRACTORS arise from three distinct and separate points, as is usual in the genus; the PHARYNGEAL muscle originating most posteriorly nearly in the median line behind the lung cavity, and bifurcating about half-way for attachment to each side of the buccal bulb; the TENTACULAR retractors are broad and flat, the left arising from the hinder left-side of the lung periphery; the right retractor is somewhat similarly placed, but a trifle removed from the lung; both divide about the middle of their course into a chief muscle for the ommatophore of their respective sides of the body, and a subsidiary one for the lower tentacle, the latter branching again to send a slip to the buccal or labial lobe.

FIG. 191.—Cephalic retractors of *Arion ater* × 2.

The REPRODUCTIVE ORGANS are comparatively simple; the dark-brown spherical OVOTESTIS is placed behind the stomach, and is traversed medially by an artery; the HERMAPHRODITE DUCT is long and tortuous, terminating in a slightly swollen and acutely bent junction with the ovispermatoduct, representing the VESICULA SEMINALIS; the pale ALBUMEN GLAND is large and compact, but much indented; the OVISPERMATODUCT is very long; the OVIDUCT is a delicate bluish ruffle above,

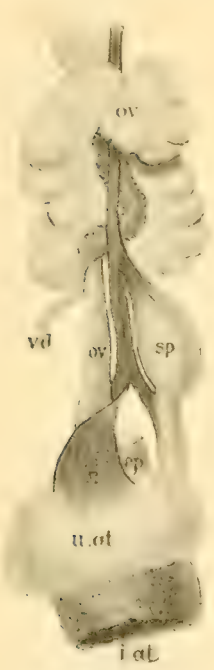


FIG. 192.

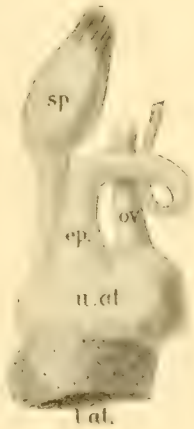


FIG. 193.

FIG. 194.

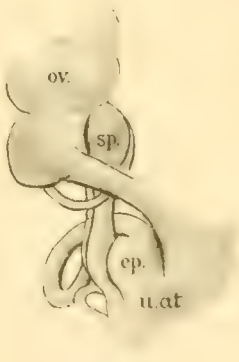


FIG. 195.

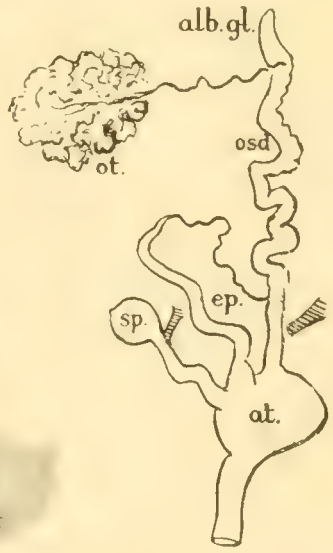


FIG. 196.

The Reproductive system of adult and juvenile *Arion ater* (L.), showing the muscular arrangements and the modifications of the organs arising during growth × 3.

FIG. 192.—The proximal end of the organs with the epiphallus removed to show the arrangement of the retractor and attachment of the spermatheca.

FIG. 193.—The organs as seen from the opposite side, with oviduct and genital retractor removed.

FIG. 194.—Spermatheca and oviduct, showing attachment of retractor.

FIG. 195.—Proximal end of sexual organs, showing their complex natural arrangement.

FIG. 196.—Sexual organs of an immature example.

alb.gl. albumen gland; *l.at.* glandular lower atrium; *u.at.* and *at.* upper atrium; *ot.* ovotestis; *ov.* oviduct; *osd.* ovispermduct; *ep.* epiphallus, cut short; *sp.* spermatheca; *v.d.* vas deferens; *r.* genital retractor, showing attachment to spermatheca duct, oviduct, and atrium.

narrowing below, while the yellowish SPERM-DUCT, or prostate, increases in calibre as it descends; the two channels being closely connected together; the slender VAS-DEFERENS expands into a thick EPIPHALLUS, which secretes the moderately slim, brownish, and denticulate spermatophore; the ovately-globose SPERMATHECA is connected by a shortish stalk with the atrium, into which the epiphallus, oviduct, and spermatheca all debouch; the upper ATRIUM, or "egg-sac," is immensely bulged at one side, the protuberance originating at the base of the oviduct, and contains an erectile linguiform appendage, which is probably a SARCOBELUM. The GENITAL

RETRACTOR is a powerful muscle, arising from the left-side of the lung-floor, near the root of the tentacular retractor; it separates into two branches, a stout retractor muscle attached to and partially ensheathing the free-oviduct, but continued to the upper atrium and a somewhat more delicate branch, which is attached to the duct of the spermatheca, close to the vesicle. In addition there is a broad flat retractor muscle which also connects the atrium with the upper left side of the lung cavity.

In full development the upper atrium is somewhat divided by a visible constriction from the lower atrium, which is closely invested by a yellow glandular pad; in younger animals the lower VESTIBULE is long and slender, but does not develop its yellow glandular investment until maturity is approaching.

In the black and very dark varieties, in which there is an abundance of black chromatophores, the proximal portions of the various organs, especially the oviduct and epiphallus, are liable to become more or less darkly tinged with them.

The ALIMENTARY CANAL is spirally triodromous, and shows itself to have been involved in the torsion which the whole visceral mass exhibits, the twisting in adults being equivalent to 1½ whorls; the STOMACH TRACT extends most posteriorly and is separated by a marked constriction from the large brownish CROP, which is deeply wrinkled internally, and overspread externally with a network of large white circulatory vessels, the lacteals of early authors; the ŒSOPHAGUS is purplish, with darker stripes, and from its origin to the nerve-ring is united to the buccal-mass; the SALIVARY GLANDS large, white, multilobed, and flocculent, spreading transversely and encircling the œsophagus like a horse-collar, or sometimes with ends turned up like a moustache; SALIVARY DUCTS thick; DIGESTIVE GLAND dark brown or dark olive, the left lobe forming the end of the visceral mass, while the right lobe lies more anteriorly.

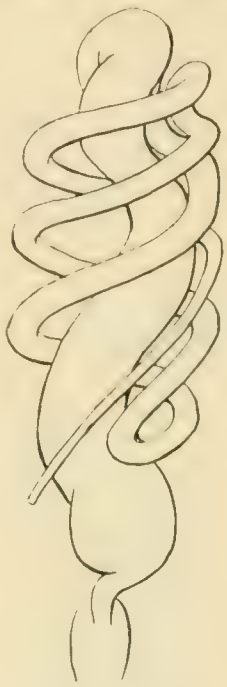


FIG. 197.

FIG. 198.

FIG. 197.—Alimentary canal of *A. ater*, adult × 2.
FIG. 198.—Alimentary canal of immature *A. ater*, showing at this stage its more intimate relationship with *Arion subfuscus* × 3.

In young and half-grown individuals the alimentary system quite resembles that of *A. subfuscus*, showing a much shorter and apparently less complex arrangement than in adults, a feature due to the shorter course of its various tracts.

The MANDIBLE or jaw is about three mill. broad and one mill. wide, strongly arcuate from front to back, and with a distinct fibrillar elasma, the upper half of the jaw is imbedded in the tissues, and is of a moderately dark amber-brown, the exposed or cutting half is much darker or almost black, the line of separation of the two different shades being very perceptible and well defined; the anterior surface bears from fifteen to eighteen strongly prominent and rounded vertical ribs which strongly crenulate the cutting edge, and also slightly indent the upper margin.

FIG. 199.—Mandible or jaw of *Arion ater* × 12. (Dublin, Mr. J. R. Redding).

The LINGUAL MEMBRANE is oblong in shape, about seven mill. long, and three mill. in width, composed of about 160 slightly curved transverse rows of closely-set teeth, which do not appreciably decrease in size towards the margins; each row is

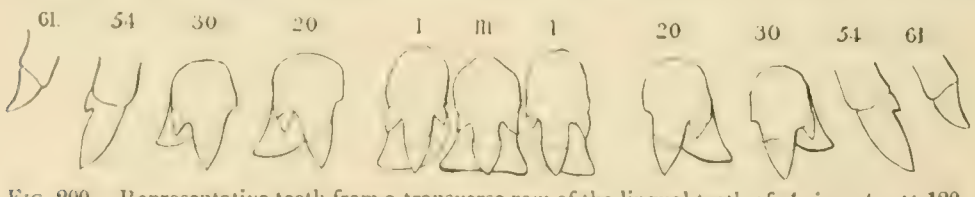


FIG. 200.—Representative teeth from a transverse row of the lingual teeth of *Arion ater* × 120. The animal collected at Dublin by Mr. J. R. Redding, and the palate prepared by Mr. J. W. Neville.

constituted by a tricuspid median tooth, flanked by about twenty-six rows of lateral teeth, which though obscurely tricuspidate adjoining the median row, gradually become distinctly bicuspid; the marginal teeth are mainly bicuspid; the mesocone increasing vastly in size and importance, the endocone totally disappearing, and the ectocone diminishing greatly until in the extreme marginals it also becomes totally lost, and the teeth are simply aculeate.

The formula of a Dublin specimen, collected by Mr. J. R. Redding, is

$$\frac{3}{2}\frac{5}{1}+\frac{2}{3}\frac{6}{2}+\frac{1}{3}+\frac{2}{3}\frac{6}{2}+\frac{3}{2}\frac{5}{1}\times 160 = 9{,}760.$$

Reproduction and Development.—The congress of this species is preceded by the prolonged circular procession previously described, and which may be continued for an hour or more, the head of each animal resting upon the tail of its partner during the promenade, and both slowly devouring the mucus exuded by the caudal gland and by the body cells. The congress is not of long duration, the union being effected by the extrusion of the genital cloaca, especially of the oviduct, etc., which constitute the intromittent organ, the seminal element being mutually transferred by means of the denticulate spermatophores.

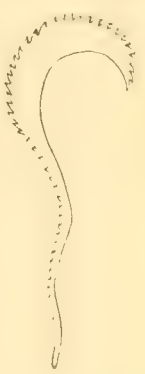


FIG. 201.—Spermatophore of *A. ater* v. *rufa*, enlarged (after Moquin-Tandon).

This species, however, sometimes reproduces parthenogenetically, as Mr. F. W. Wotton has reared individuals in captivity, which though kept strictly isolated almost from birth, produced fertile eggs.

The eggs, which are excluded in from four to five weeks after the union has taken place, are about five mill. long, and four mill. in diameter, somewhat oval in shape, thick skinned, and semipellucid when fresh, but quickly changing to an opaque-white, a circumstance ascribed to the innumerable calcareous particles in the outer envelope, this calcification tallying with the copious deposit of lime in the arterial walls. They are deposited in vast numbers at almost all seasons of the year—many clusters have been found as early as January in this country—under stones, old wood, dead leaves, at roots of plants, etc., usually in clusters of from twenty to fifty, or more; they hatch in from thirty to fifty days, according to the weather.

The young when hatched are usually unicolorous, but apparently vary in shade, in different countries; in Germany, Scandinavia, and North Central Europe they are said to be pale yellow or greenish-white, but more inclined to blackish in the mountain regions, while in the warm plains and in the south they are reddish, and in England frequently of a yellowish or greenish-grey, with slightly darker shield and head, often closely conforming in tint to the fallen faded leaves of autumn. In many cases lateral banding develops during growth, which may occasionally, especially near the outskirts of its range, persist in adult life, but usually the darker markings become clouded over and the unicolorous stage is reached.

Mr. W. A. Gain has carefully chronicled the varied changes undergone by animals during growth. At eighteen mill. in length they were almost without exception of a greenish-yellow tint, with greyish lines and markings, but this in some cases would gradually but quickly change to a brownish tint, the tint gradually becoming a rich brown with dark lateral bands on body and shield, and eventually when full grown presenting a deep brown back and shield, with black-brown sides and orange fringe. Other specimens, apparently quite similar when young, may become very differently coloured as adults.

In winter, when half-grown, they are very apathetic, coiling themselves up in a serpentine fashion, and huddling together in a close and compact mass when in company with others. They grow very little during this period, as they take little food; but with the advent of warmer weather their activity increases, they eat greedily, and rapidly increase in size.

Food and Habits.—This species is very voracious, and almost omnivorous, as is demonstrated by the fact certified by Mr. Gain, that out of 197 different kinds of food, only 39 were refused, while decaying animal or vegetable matter, excrement, edible and poisonous fungi, paper, weak or injured worms or animals of its own or other species are readily devoured.

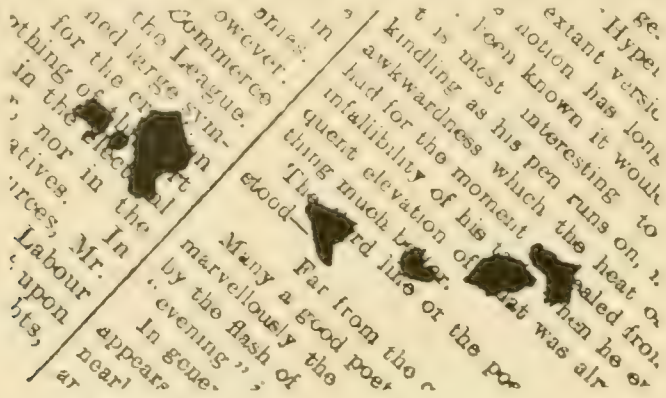


FIG. 202.—Fragment of newspaper, as eaten by *Arion ater*, showing the character of the feeding-track (after H. Wallis Kew).

The colour of the fæces is also singularly responsive to the nature of the food, Mr. H. W. Kew stating that the fæcal matter of individuals kept in confinement and fed upon fresh green leaves was always dark green, but when fed upon apple became of an amber colour; if petals of *Ranunculus* were eaten the excreta was deep yellow, but changed to a scarlet colour when the animals were fed upon the berries of *Arum maculatum*.

It is very sluggish and indolent, and recovers itself with difficulty when placed on its back; if startled or irritated it shrinks into a characteristic hemispherical lump, and sways its body from side to side in a peculiar rolling way. The favourite localities of this species are moist shady places in woods, fields, and gardens; it would seem to more especially prefer roadsides and hedgerows. They emerge from their hiding-place at dusk and during the night, but in moist or cloudy weather they come forth during the day, their appearance at that time being popularly believed to prognosticate rain.

Superstitions, Folk Lore, etc.—The calcareous matter found beneath the shield of *Arion ater* was formerly believed to possess great and varied medicinal virtues. It was firmly believed to be an infallible specific in cases of consumption, and was amongst other methods prescribed to be swallowed alive by the sufferer; even at the present day, in some parts, a poultice of slugs, placed upon the chest, is considered to have a very beneficial effect in chest complaints. The ancient physicians also regarded the powder resulting from the drying of the vestigial shell as a very effective remedy for dysentery, while Pliny records the same powdery-dust as a remedy for the teeth.

In many parts of England, the country people still have a marvellous faith in the use of this mollusk for the removal of warts; the method being to well rub the wart with the body of the slug, which by the rubbing

is believed to be impregnated with its matter, the slug is then securely impaled upon a thorn, where it dies, and gradually withers up, by which time the wart will also have disappeared. In Northamptonshire it is considered necessary to repeat the operation on nine successive nights, by which time the wart will have gone.

In 1890 Mr. Kew observed an old man in a garden at Highgate, in the suburbs of London, engaged in gathering *A. ater* for the purpose of making ointment; while in Lincolnshire the appearance of "black snails" is regarded, especially at harvest time, as a most reliable sign of impending rain.

In former times, the ancients in their ignorance of mollusca, believed that slugs in general, and this one in particular, as being the most obvious and conspicuous of them, to be the same animals as those possessed of shells, and Albertus Magnus and Gesner, influenced in part by a passage in Ælian, believed that snails had the power of quitting and returning to their shells at pleasure, while Kramer in 1736 attempted to prove that this was actually the fact.

Fossil.—The chalky granules, believed to be the internal shells of *A. ater*, are recorded by Sandberger from the gravels and brick-earths of the Upper Pleistocene beds of this country.

Pleistocene.—Messrs. Kennard and Woodward report it as found in the beds at Swalecliffe, a mile west of Herne Bay, in East Kent; and in the same deposits at Ilford and Uphall, in South Essex.

In France it is known from beds of similar age in the Somme Valley.

Holocene.—In West Kent, the same authors chronicle its occurrence at Maidstone, in a disused chalk-pit, near Otford railway station, and in a deposit on face of chalk escarpment, at Exedown, near Wrotham. In Surrey, at the Horse-shoe deposit, Colley pit, Reigate, the internal granules were very abundant between the 2-feet and 3-feet levels. In Essex, they have been found in the alluvium at Walthamstow. In Berkshire, in the Kennet Valley deposits at Newbury; and in Oxfordshire at Westbury and Clifton-Hampden, near Oxford.

Parasites and Enemies.—In addition to the numerous enemies of the mollusca generally, *Arion ater* is internally infested by three different species of *Leptodera*, a genus of Nematoid worms. *Leptodera appendiculata*, a species remarkable for the possession of a pair of caudal fringes, inhabits the foot of this species while in the larval state, becoming sexual in the decomposing body of the snail at its death. Another species is found in the intestinal canal, and the third species in the salivary glands.

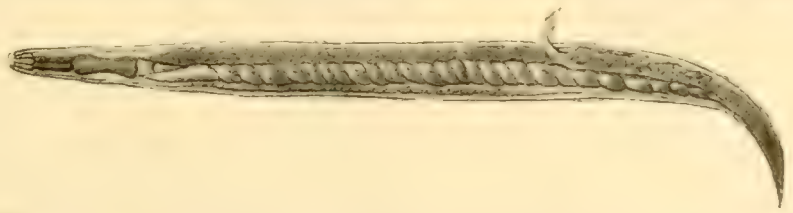


Fig. 203.—An Entozoic Parasite from *Arion ater* var. *rufa* × 50 (after Van den Broeck).

Professor Owen records that the larva of a *Tænia* is found encysted in the pulmonary sac, which is believed to attain its full sexual maturity only when occupying the intestinal canal of some warm-blooded animal.

M. Van den Broeck records the abundance of a species of Entozoon in the intestinal canal of the var. *rufa*, but which was first detected within the egg of *Limax arborum*.

Variation.—Scarcely any species is more variable in its colouring than *Arion ater*, but nearly all the variations resolve themselves into two chief lines, the red and the black, the presence, absence or varying proportions of these constituents determining the tints; their total absence causing the whitish or greenish varieties.

The red pigment, which is said by Simroth to be a warning colour,[1] resides in the dermal mucous cells, and is developed by warmth, a warmer or milder temperature during the growth period increasing the proportion of rufous individuals, or intensifying and enriching their tint. When the colour glands are but feebly developed, it gives rise to the yellow tint and the intermediate shades. This colouring is, however, very unstable and also in great part due to the mucosity, as when this is quite removed the animals often appear of an uniform grey or brown.

The black pigment resides in the cellules of the integument, and its predominating development is in a large measure due to cold or moisture, as the dark varieties are found most numerously in cold or mountainous countries, Eimer especially remarking upon the predominance of the dark varieties at high altitudes on the mountains and also upon their greater prevalence upon the plains during wet seasons.

In this country, also, *Arion ater* is usually dark coloured or black, this sombre colouring is, however, not invariably that of the youthful stages, but is usually an acquired colour, the result of changes during growth, and though unicoloration is doubtless the ultimate or final stage of pigmentation, the shade or hue is probably in great part dependent upon and modified by the conditions of the environment with which the coloration of the body tends to harmonize.

Some of the more severely critical of modern authors variously divide *Arion ater* into two, three, or more species, influenced by trifling external differences or by slight inequalities in the degree of development of the various organs of the reproductive system, the modifications of which are due in a large degree to individual variation or to the stage of sexual maturity attained by the animals examined. The differences in the amount of enlargement of the atrium or vestibule and its more or less apparent division into an upper and lower section, or the slightly differing points of attachment of the retractors are chiefly relied upon as establishing at least two species, which are distinguished as *Arion empiricorum* and *A. ater*, the former name being usually though not invariably allowed to include what is generally known as *Arion rufus*.

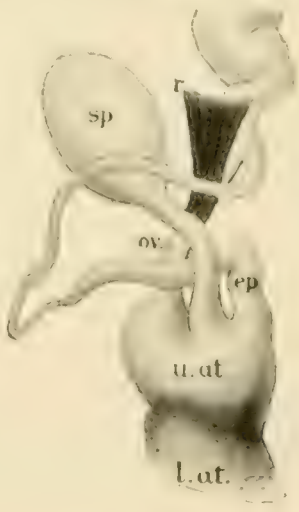


Fig. 204.

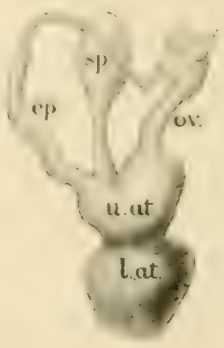


Fig. 205.

Proximal end of the Reproductive organs of *Arion rufus* and *A. ater* according to Pollonera.

Fig. 204.—*Arion rufus* (L.), sensu stricto (after Pollonera).
Fig. 205.—*Arion ater* (L.), sensu stricto (after Pollonera).
ep. epiphallus; *sp.* spermatheca; *ov.* free oviduct; *r.* genital retractor; *l.at.* lower atrium; *u.at.* upper atrium.

1 Monog. i., p. 330.

The *A. empiricorum* is considered as chiefly West European and to be the form inhabiting this country. It is noted as mainly characterized by its very short and insignificant lower vestibule and the large and wide upper section, an enlargement due to the swollen outlets of the organs debouching therein.

A. ater is said to be confined to North-eastern Europe, and has been described as differing by its larger size and in possessing a thick and swollen lower vestibule, while the upper section is less noticeable owing to the undeveloped state of the oviduct and other outlets.

These differences are, however, little more than individual, local, or seasonal variations in the development of the different organs, as is affirmed by Dr. Babor, who shows that the varied development of the atrium is merely the expression of sexual phases, while Signor Pollonera has conclusively demonstrated the unreliability and fugitive character of the vestibular modifications and their unsuitability for specific differentiation in *Arion*.

VARIATIONS IN COLOUR OF ANIMAL.

Var. **atra** L., Syst. Nat., ed. x., 1758, p. 652.

The strict type of this species is undoubtedly the black or blackish form, with the median area of the foot-sole markedly paler than the side zones. It has, however, had a number of special names devoted to it by various observers and is probably:—

Limax ater L., op. cit.
Arion empiricorum aldrovandii Kalenicz., Bull. Mosc., 1851, p. 113.
Arion rufus β ater Moquin-Tandon, Hist. Moll. France, 1855, ii., p. 10, pl. 1, f. 20.
Arion (*Limax*) *ater* var. *niger* Dum. & Mort., Moll. Savoie, 1857, p. 6.
Arion rufus var. *nigra* Baudon, Journ. de Conch., 1884, p. 196.
Arion empiricorum var. *maurus* Held.

The distribution of this form is almost universal in this country, as it is one of the variations more especially evolved by our cool and moist climate.

On the continent, this form is found in Germany, Holland, Belgium, France, North Spain, Portugal, Norway, up to 66° 49′ north latitude, South Sweden, Denmark, Austro-Hungary, Switzerland, and North Italy.

Var. **aterrima** Taylor.

Body, shield, and creeping disc uniformly black.

It is desirable to discriminate from the ordinary form the jet-black individuals, in which the black pigment has also overspread the whole surface of the creeping disc. This variety is not common, and would seem to be more especially a northern or mountain form, as its occurrence in other places seems to be more or less sporadic or casual. Mr. Welch and Mr. Praeger, in Oct. 1897, found some very characteristic examples on the summit of Slieve-Donard at an altitude of 2,796 feet.

It is not improbable that *Arion hispanicus* of Simroth, which is characterized by its smaller size and uniform black body and creeping disc, belongs to this variety.

Many authors describe variations of this species as *aterrimus totus*, but it is not by any means clear that the descriptions were intended to apply to the foot-sole as well as the body.

ENGLAND AND WALES.

Devon N.—Ilfracombe, July 1904 ! R. Leach.
Huntingdon—Garden, Huntingdon, Sept. 1904 ! Miss Emily M. Foster.
Gloucester E.—Cirencester, Aug. 1904 ! Mrs. Blundell.
Merioneth—Hills above Barmouth, alt. 2,000 feet, Aug. 1884 ! J. Hopkinson.
Lincoln N.—Rippingale, Sept. 1904 ! H. Preston.
Cheshire—Garden, Broad road, Sale, May 1885 ! C. Oldham.
Lancashire W.—Over Wyresdale, alt. 1,000 ft., April 1903 ! Rev. W. W. Mason.
York N.E.—Runswick Bay, June 1885 ! W. Denison Roebuck.
York Mid W.—Summit of Oughtershaw Moor, Wharfedale, Aug. 1904 ! W. Denison Roebuck.
Durham—Croft, April 1887 ! and near High Force, June 1884 ! Baker Hudson.
Westmorland—On the summit of Coniston Old Man, alt. 2,660 feet, July 1887, S. C. Cockerell. Grange-over-Sands, July 1904 ! W. J. Davey.
Cumberland—Salkeld Dykes, Penrith, July 1904 ! H. Britten. Scafell Pikes, alt. 3,000 feet ! W. West.

SCOTLAND.

Roxburgh—Langlee near Galashiels, Sept. 1904 ! J. Roseburgh.
Berwick—Fans near Earlston, Aug. 1883 ! R. Renton.
Stirling—Near summit of Ben Lomond (Miss Donald, Cumberland List, 1882).
Perth S.—Callender, April 1888 ! A. Somerville ; and summit of Ben Voirlich, alt. 3,224 feet, Sept. 1902 ! W. Evans.
Banff—Aberlour, Nov. 1892 ! L. Hinxman.
Easterness—At an alt. of 2,800 feet on Ben Nevis (C. L. Wragge, Good Words, 1882, p. 382).
Ebudes S.—Machrie, Islay, Aug. 1904 ! Miss Ethel Evans.

IRELAND.

Down—Summit of Slieve-Donard, alt. 2,796 feet, Oct. 1897, R. Ll. Praeger and R. Welch ; also found above the Deer's Meadow on Slieve Muck, on Slieve Bingian, and Slieve Bernagh, R. Welch.
Louth—Carlingford, Dec. 1904 ! P. H. Grierson.
Meath—Drumcondra, July 1904 ! P. H. Grierson.
Wexford—Kilmanock, Sept. 1888 ! G. A. Barrett-Hamilton.
Kilkenny—Gardens, Kilkenny Castle, Sept. 1904 ! J. Carlton.
Leitrim—Mohill, July 1904 ! P. H. Grierson.
Sligo—Common on mountain summit above West Glencar, and at Gleniff Cave, above 1,000 feet alt., July 1904, R. Welch.
Mayo W.—Dugort, July 1904 ! P. H. Grierson.
Galway W.—Leenane Mountain, 1897, R. Welch.
Limerick—Castleconnell, Sept. 1904 ! R. A. Phillips.
Cork N.—Macroom, July 1904 ! P. H. Grierson.
Kerry—Common on roadsides at an alt. of 600 to 1,000 feet, near Moll's Gap, Kenmare, May 1898, R. Welch.

CONTINENTAL DISTRIBUTION.

Spain—*Arion hispanicus* is recorded for Mid Spain by Simroth.
Portugal—*Arion hispanicus* is recorded from Sierra Estrella by Simroth.

Var. **castanea** Dum. & Mort., Cat. Moll. Savoie, 1857, p. 6.

Arion ater var. *brunnea* Roebuck, Proc. Roy. Irish. Acad., 1886, p. 673.
Arion ater var. *seminiger* T. D. A. Cockerell, Science Gossip, 1889, p. 141.
Arion ater sub-var. *olivacea* Taylor.

ANIMAL almost uniformly brown, usually with a paler and brighter foot-fringe ; the pale varieties are the *brunneo-pallescens* of Roebuck and the *fusca-lutescens* of Cockerell.

The sub-var. **semi-nigra** of Cockerell is intermediate between the type and var. *brunnea*, possessing a black body and very dark-brown shield.

The sub-var. **olivacea** has the brown of the body tinged with a greenish hue. The var. *olivacea* of Lehmann, 1856, is considered by Simroth to be probably a young form of *Arion ater* but is more likely to be a variety of *A. subfuscus*.

In Ireland, according to Dr. Scharff, the olivaceous varieties are entirely restricted to the west coast.

ENGLAND AND WALES.

Devon N.—Northam, Nov. 1885 ! W. A. Gain. Belstone near Okehampton, Sept. 1904 ! Rev. W. W. Mason. Ilfracombe, Mch. 1887 (Tomlin, J. of C., Apl. 1887).
Somerset S.—Bridgwater, in allotment gardens, Aug. 1884 ! W. Vinson.
Somerset N.—Bath, June 1884 ! C. J. Waterfall.
Wilts N.—Clyffe Pybard near Swindon, Aug. 1904 ! Rev. C. H. Goddard.
Dorset—Chideock, Bridport, Aug. 1885 ! A. Belt.
Hants. S.—Portsdown Hill, May 1885 ! W. Jeffery. Hengistbury Head, March 1884 ! Charles Ashford.
Sussex W.—Ratham, not uncommon, Oct. 1885 ! W Jeffery.
Kent E.—Shepherdswell, Aug. 1896, L. E. Adams.
Kent W.—St. Mary Cray, July 1883 (T. D. A. Cockerell, Nat. Hist. Notes, Nov. 1883, p. 124). Sub-var. *seminigra*, Chislehurst (T. D. A. Cockerell, Sci. Gossip, 1889, p. 141). Sub-var. *brunneo-pallescens*, Maidstone, Aug. 1888 ! F. G. Fenn.
Surrey—Oxshott, May 1888 ! H. Wallis Kew. Sub-var. *brunneo-pallescens*, Warlingham, Sept. 1885 ! F. G. Fenn.
Essex S.—Woodford, Sept. 1886 ! C. Oldham.
Essex N.—Stour Valley, Langham, Sept. 1886 ! G. T. Rope. On a bank by the railway station, Colchester, Aug. 1890, L. E. Adams.
Herts.—Watford, June, 1884 ! J. Hopkinson. Totteridge, May 1888 ! H. W. Kew.
Middlesex—Acton, Aug. 1884 ! and Bedford Park, Chiswick, Dec. 1884 ! T. D. A. Cockerell. Bush Hill Park, April 1887 ! Charles Ashford. Highgate, June 1888 ! H. W. Kew. Near Hendon, May 1889 (J. W. Williams, Zool., 1889, p. 272).

Berks.—Common about Maidenhead, June 1887, L. E. Adams. Sub-var. *olivacea*, Bradfield, Sept. 1904 ! Rev. E. Peake.

Oxford—Wychwood Forest on Great Oolite (Whiteave's Oxford List, 1857, p. 5). Kimmeridge clay-pits, at Shotover Hills, Rev. S. Spencer Pearce.

Suffolk W.—The prevailing form about Stratford St. Mary, Sept. 1886! G. T. Rope.

Norfolk E.—Common, Strumpshaw Hall, July 1904 ! W. J. O. Holmes. Alphington, Yelverton, and Rockland (Pearce & Mayfield, J. of Conch., July 1894, p. 392). Common in the Heigham Marshes (W. K. Bridgman, Zool., 1850, p. 2742).

Bedford—General Cemetery, Luton, April 1889 ! J. Saunders.

Northampton—Rockingham Park, Northampton, May 1896, L. E. Adams.

Gloucester W.—Var. *castanea* and sub-var. *brunneo-pallescens*, Stroud, Oct. 1883 ! E. J. Elliott. Symond's Yat, July 1891 ! W. Whitwell.

Monmouth—Banks of River Wye, Monmouth, July 1891 ! W. Whitwell.

Hereford—Bishopswood Vicarage, Ross, June 1885 ! Rev. R. W. J. Smart.

Worcester—Stourport, at Bishop's Park and Hartlebury, July 1885 (J. W. Williams, J. of Conch., July 1889).

Warwick—Sutton Park, May 1871, W. Nelson.

Stafford—Milford, June 1886 ! and a sub-var. with darker lateral bands, about Stafford, Aug. 1886 ! L. E. Adams. Barlaston Hall, July 1888 ! J. R. B. Masefield.

Salop—Sub-var. *brunneo-pallescens*, Oswestry, June 1885 ! B. Hudson.

Brecon—Erwood, Aug. 1904 ! J. Williams Vaughan.

Carmarthen—Kidwelly, Dec. 1903 ! Rev. L. Davies. Llanelly, Sep. 1904! J. Nevill.

Pembroke—Near Pembroke, June 1885 ! Mrs. Trayler. St. David's, July, 1891 ! J. Bickerton Morgan. Amroth, Sept. 1894, L. E. Adams. Holloway's Quarry, and Hoyle's Mouth, Tenby (A. G. Stubbs, J. of Conch., July 1900, p. 321).

Cardigan—Aberayron, June 1888 ! W. Whitwell.

Montgomery—Leighton Bridge and Gungrog Dingle, Welshpool, Aug. 1889 ! Sub-var. *brunneo-pallescens*, Welshpool, Aug. 1889 ! J. Bickerton Morgan.

Merioneth—Barmouth, moderately common, Aug. 1886, L. E. Adams.

Carnarvon—Llangelynen, July 1883 ! W. Denison Roebuck. Slopes of Snowdon, April 1887 ! J. Madison. Abersoch, June 1896 ! C. Oldham.

Denbigh—Marshy field, Bodscallan, July 1883 ! W. Denison Roebuck.

Lincoln S.—Careby Wood, Aug. 1904 ! H. Preston.

Lincoln N.—Common in Grisel-bottom, Burwell Wood, Sept. 1886 ! also on walls of cemetery, London road, Louth, June 1887 ! H. Wallis Kew. Abundant in Well Vale, Alford, Sept. 1889 ! W. Denison Roebuck. Cadney, Aug. 1902 ! and Tattershall, Sept. 1904 ! Rev. E. A. Woodruffe-Peacock. Sub-var. *brunneo-pallescens*, Louth, and Grisel Bottom, Aug. 1886 ! H. Wallis Kew.

Leicester—Old John Hill, Bradgate Park, June 1885 ! H. E. Quilter. Sub-var. *brunneo-pallescens*, Sheepshed, Sept. 1884 ! C. T. Musson.

Notts.—Cresswell Crags, April 1884 ! Felley Abbey, Sept. 1884 ! Newark, Oct. 1884 ! and Wollaton, Nov. 1884 ! C. T. Musson. Abundant in garden, Tuxford, July 1885 ! W. A. Gain. Corporation gardens, Nottingham, July 1888 ! G. W. Mellors.

Derby—Pleasley Vale, April 1884 ! C. T. Musson. Marple, May 1885 ! C Oldham.

Cheshire—Common at Sale and Northenden, June 1885 ! C. Oldham. Kingway near Bowdon, July 1885 ! J. G. Milne. Marple, May 1892 ! C. Oldham.

Lancashire S.—Whalley, Sept. 1888 ! C. Oldham.

York N.E.—Stream-side, Ramsdale Wood, Robin Hood's Bay, June 1888 ! W. D. Roebuck. Vicarage garden, Ingleby Greenhow, Sept. 1890 ! Rev. J. Hawell.

York S.W.—Common at Shipley Glen and Hawkesworth (Soppitt and Carter, Nat., 1888, p. 97). Green Spring Wood, Barnsley, Sept. 1899 ! W. E. Brady. Grimescar, Huddersfield, Oct. 1903 ! H. G. Brierley. A sub-var. with yellowish fringe, Heckmondwike, Oct. 1903 ! T. Castle. Aldborough, T. Petch.

York Mid W.—Guy's Cliffe Wood, Pateley, Sept. 1882 ! W. Denison Roebuck. Near Kirby Malzeard, Aug. 1885 ! W. E. Collinge.

York N.W.—Grinton, Aug. 1885 ! W. Denison Roebuck.

Durham—Durham, April 1884 ! Baker Hudson.

Isle of Man—Slopes of Snaefell, Sept. 1891 !

SCOTLAND

Ayr—Cumnock (Rev. J. McMurtrie, Journ. of Conch., April 1883).

Lanark—Wishaw (Rev. J. McMurtrie, Journ. of Conch., April 1883).

Peebles—Leadburn, July 1889 ! W. Denison Roebuck.

Stirling—Bucklyvie, April 1896 ! W. Evans.

Sutherland E.—Rock, south of the Mound, Brora, June 1885 ! W. Baillie.

Hebrides—Castlebay, Isle of Barra, Sept. 1889 ! Rev. J. E. Somerville.

Shetlands—Colla Firth, Yell Sound, Aug. 1886 ! Rev. R. W. J. Smart.

IRELAND.

Derry—Ballynagard, 1892 ! and Gortness, Sept. 1904 ! D. C. Campbell.

Antrim—Cushendun, May 1886 ! and Whitehall, Broughshane, June 1886 ! Rev. S. A. Brenan. Murlough, May 1897, L. E. Adams. Colin Glen, with type, 1899, R. Welch. Ballycastle, Sept. 1904 ! Miss F. S. O'Connor.

Down—Newcastle, Oct. 1884 ! Rev. H. W. Lett.

Armagh—Armagh, June 1885 ! Rev. H. W. Lett.

Monaghan—Carrickmacross, July 1904 ! P. H. Grierson. Drumreaske, Sept. 1904 ! W. F. de Vismes Kane.

Tyrone—Altadawin, July 1886 ! Aughnacloy, July 1886 ! and Favour Royal, Aug. 1886 ! W. F. de Vismes Kane. Baronscourt, Sept. 1904 ! Robert Bell.

Donegal—Croaghross, Letterkenny, May 1889 ! H. C. Hart. Bundoran, Aug. 1889 ! J. G. Milne. Templemore Park, Londonderry, Sept. 1904 ! D. C. Campbell. Mulroy Bay near Milford, R. Welch.

Fermanagh—Enniskillen, Sept. 1904 ! Dean of Clogher.

Cavan—Cavan, Sept. 1904 ! R. Welch.

Louth—Piperstown, Nov. 1889 ! Miss Sidney Smith. Blackhall Demesne, Sept. 1904 ! and Narrow Water, Dec. 1904 ! P. H. Grierson.

Meath—Drumcondra, July 1904 ! P. H. Grierson.

Dublin—Kingstown, May 1886 ! W. F. de Vismes Kane. Howth, April 1887 ! and Leeson Park, Dublin, Oct. 1890, R. F. Scharff. Road-sides, Donnybrook, Aug. 1888 ! G. A. Barrett-Hamilton.

Kildare—Naas, Oct. 1904 ! R. J. Pack-Beresford.

Wicklow—Not so common as the black and dark-grey forms, R. F. Scharff.

Wexford—Kilmanock, Sept. 1888 ! G. A. Barrett-Hamilton.

Carlow—Fenagh House, Bagenalstown, Sept. 1904 ! Denis R. Pack-Beresford.

Queen's Co.—Stradbally, Sept. 1904 ! A. G. Stuart.

King's Co.—Birr, Sept. 1904 ! Miss Hemphill.

Roscommon—Old Fort, Keadue, Sept. 1904 ! James M. Welch.

Leitrim—Tullaghan, Aug. 1889 ! R. F. Scharff. Mohill, July 1904 ! P. H. Grierson.

Sligo—Collooney, Sept. 1885 ! and Rockwood, Lough Gill, Oct. 1886 ! W. F. de Vismes Kane.

Mayo E.—Manulla Junction, Sept. 1904 ! W. West.

Mayo W.—Enniscoe demesne, Crossmolina, Sept. 1885 ! W. F. de Vismes Kane. Kylemore Castle Gardens, Sept. 1904 ! W. Comfort.

Galway W.—The predominant variety at Killereran, B. J. Clarke (Thompson, Ann. and Mag. N.H., Nov. 1840, p. 202). Aran Isles, Nov. 1890, R. F. Scharff. Gentian Hill, July 1895 (R. Standen, Irish Nat., 1895, p. 267).

Galway E.—Dernasliggan, April 1897, R. Welch. Var. *castanea* and sub-vars. *brunneo-pallescens* and *olivacea*, Clonbrock, Oct. 1904 ! Hon. R. E. Dillon.

Clare—Doonass, Aug. 1904 ! and Cratloe, Sept. 1904 ! R. A. Phillips. Woodpark, Scariff, Sept. 1904 ! N. F. Hibbert. Gardens, Dromoland Castle, Sept. 1904 ! J. Carter.

Limerick—Castleconnell, July 1904 ! R. A. Phillips. Limerick, Sept. 1904, G. J. Fogerty.

Tipperary N.—Var. *castanea* and sub-var. *olivacea*, shores of Lough Derg, etc., Sept. 1904 ! G. J. Fogerty.

Tipperary S.—Melview, Clonmel, Oct. 1904 ! Mrs. Malcolmson.

Waterford—Near Waterford, Sept. 1883 ! J. H. Salter.

Cork N.—Mallow, Nov. 1885 ! W. F. de Vismes Kane. Queenstown, May 1891, R. F. Scharff. Macroom, July 1904 ! P. H. Grierson. Convamore, Ballyhooley, Sept. 1904 ! J. N. Milne. Near Cork, Sept. 1904 ! C. Baker.

Cork S.—Glengariff, May 1891, R. F. Scharff.

Kerry—Cloonee (Irish Nat., 1895, p. 220). Kenmare, July 1898 (R. Standen, Irish Naturalist, Sept. 1898). Killflynn, Sept. 1904 ! J. Julian. Var. *castanea* and sub-var. *olivacea*, Valentia Island, Sept. 1904 ! Miss M. J. Delap. Sub-var. *olivacea*, Great Skellig (R. F. Scharff, Irish Naturalist, Jan. 1898).

CONTINENTAL DISTRIBUTION.

Germany—The brown variety is the prevalent one in Osnabruck, according to Borcherding. Plentiful, but small, about Berlin, according to Stein.

France—Recorded from Montpellier in the Herault by Grateloup; from the Vosges by Puton; from Côte d'Or by Beaudouin; from Pas-de-Calais by Bouchard-Chantereux; from Grande-Chartreuse in the Isère, and from Aix-le-Bains in Savoy by Bourguignat; while Dumont and Mortillet describe it as most abundant in the basin of the Lake of Geneva and in Savoy generally.

Switzerland—Commonest form about Berne (Studer, M. T. Ges. Berne, 1884). Foot of Mt. Pilatus, Aug. 1885 ! S. Chadwick.

Var. **plumbea** Roebuck, Journ. of Conch., Jan. 1884, p. 146.

Arion ater var. *cinerea* Roebuck, Nat., Sept. 1888, p. 284.
Arion ater var. *cinerascens* Cockerell, Science Gossip, Feb. 1893, p. 25.

ANIMAL uniform lead colour, sides paler, fringe dull yellow.

The sub-vars. **cinerea** and **cinerascens** are strictly identical, and are described as uniformly dark cinereous in colour, a dull brown foot-fringe with deep cinereous lineolation. The form may be regarded as including the pale plumbeous specimens discriminated by Mr. Roebuck under the name of *plumbeo-pallescens*.

ENGLAND AND WALES.

Cornwall W.—A sub-var. banded with a darker shade, Trevedock road, St. Columb, May 1885 ! W. Vinson.

Cornwall E.—St. Austell, Sept. 1904 ! C. P. Richards.

Devon N.—Belstone, near Okehampton, Sept. 1904 ! Rev. W. Wright Mason. Ilfracombe, Aug. 1903 (Beeston & Wright, J. of Conch., July 1904).

Somerset S.—Bridgwater, Sept. 1884 ! W. Vinson.

Surrey—Dorking, Sept. 1886 ! C. Oldham. Sub-var. *cinerea*, with orange fringe, Bletchingley near Reigate, Aug. 1903 ! L. E. Adams.

Middlesex—Muswell Hill road, Highgate, July 1888 ! and Churchyard Bottom, Highgate, April 1889 ! H. W. Kew. Sub-var. *cinerascens*, Bedford Park (T. D. A. Cockerell, Science Gossip, 1885, p. 224).

Oxford—Churchyard, Combe, abundant, July 1904 ! Rev. S. S. Pearce.

Bedford—General Cemetery, Luton, April 1889 ! J. Saunders.

Glamorgan—Cardiff, Nov. 1889 ! F. W. Wotton. Sub-var. *plumbeo-pallescens*, near Llanelly, Sept. 1904 ! J. Nevill.

Pembroke—Tenby, Aug. 1884 ! J. Madison.

Montgomery—Sub-var. *cinerea*, with yellow fringe, Welshpool, Aug. 1889 ! J. Bickerton Morgan.

Carnarvon—Sub-var. *cinerea*, Llanrwst, July 1883 ! W. Denison Roebuck.

Leicester—Bradgate Park, Leicester, June 1887 ! H. E. Quilter.

Notts.—Pleasley Vale, April 1884 ! C. T. Musson. Sub-var. *cinerea*, Tuxford (W. A. Gain, Brit. Nat., 1893).

Derby—Markland Grip, April 1884 ! C. T. Musson. Near Ashbourne, Aug. 1889 ! Lionel E. Adams.

York N.E.—Egton Bridge, Aug. 1885 ! Baker Hudson. Farwath Bridge, Aug. 1886 ! and Skelton Beck Valley, Saltburn, May 1887 ! W. Denison Roebuck.

York S.W.—Shipley Glen (Soppitt and Carter, Naturalist, 1888, p. 97).

York Mid W.—Road-side near Pool, Aug. 1883 ! W. Denison Roebuck. Wrangthorn Churchyard, Leeds, Sept. 1890 ! A. N. Skipwith.

York N.W.—Angram, Swaledale Head, July 1884 ! W. Denison Roebuck.

Durham—Durham, July 1884 ! Baker Hudson.

Northumberland—Stocksfield-on-Tyne, May 1885 ! H. E. Craven.

Cumberland—Brigham, Cockermouth, Sept. 1904 ! Mrs. Robinson.

SCOTLAND.

Aberdeen N.—Haddo House, Nov. 1890 ! G. Muirhead.

Sutherland E.—The Mound Rock above Loch Brora, Sept. 1884 ! W. Baillie.

IRELAND.

Derry—Creagh Meadows, Toome, June 1893, R. L. Praeger and R. Welch.

Antrim—A sub-var. laterally banded with darker, Whitehall, Broughshane, June 1886 ! Rev. S. A. Brenan. Murlough, May 1897, L. E. Adams. Cave Hill, 1893, and Glenavy River, May 1900, R. Welch. Garden, Manse, Antrim, Sept. 1904 ! W. S. Smith. Ballycastle, Oct. 1904 ! Miss O'Connor.

Down—Garden, Oakleigh, Ormeau Park, Belfast, Oct. 1904 ! A. W. Stelfox. Beech Hill near Newry, July 1904 ! R. J. Anderson.

Monaghan—Drumreaske, Sept. 1904 ! W. F. de Vismes Kane.

Donegal—Mulroy Bay near Milford, R. Welch.

Meath—Sub-var. *cinerea*, Duleek, Nov. 1904 ! P. H. Grierson.

Wicklow—A dark-grey form at Altidore, July 1891, R. F. Scharff.

Wexford—Kilmanock, Sept. 1890, G. A. Barrett-Hamilton.

Sligo—Rare about Sligo, July 1904, A. Stelfox and R. Welch.

Mayo W.—Enniscoe demesne, Crossmolina, Sept. 1885 ! W. F. de Vismes Kane.

Tipperary N.—Shores of Lough Derg, etc., Sept. 1904 ! G. J. Fogerty.

Cork S.—Sub-var. *cinerea*, with orange fringe, common about Cork, Blarney, and Bantry, Sept. 1898, Lionel E. Adams.

Kerry—Kenmare, July 1898 (R. Standen, Irish Nat., Sept. 1898). Valentia Island, Sept. 1904 ! Miss Delap.

CONTINENTAL DISTRIBUTION.

France—A grey variety is recorded from the Valley of Tremorgau in Finistère by Bourgnignat.

Var. **hiberna** Mabille, Rev. et Mag. Zool., 1868, p. 134.

Arion hibernus Mabille, op. cit.
Arion empiricorum var. *violescens* Collinge, mss.

ANIMAL of a beautiful rusty purple, paler at the sides; in alcohol the brilliant and velvety aspect is lost and the animal becomes of a purply-black.

Edinburgh—A deep purple variety, Braidburn near Edinburgh, July 1888! W. Eagle Clarke.

Fife and Kinross—Var. *violescens*, St. Andrews, W. E. Collinge.

Dublin—An uniformly claret-coloured variety, amongst the fallen pine needles, which they much resemble, in the pine-woods at Howth and Killakee, in the Dublin Mountains, Sept. 1890, R. F. Scharff.

France—Found in winter only in the Forests of Meudon and Bondy in the Department of the Seine; it has also been reported from the Aisne, Oise, Seine et Marne, and Seine et Oise.

Var. **rufa** L., Syst. Nat., 1758, ed. x., vol. i., p. 652.

Limax rufus L., op. cit.
Limax rufus B *nigrescens* Razoumowsky, Hist. Nat. Jorat, 1798, i., p. 268.
Limax coccineus Gistel, Naturg. d. Thierreichs, 1848, p. 168.
Arion empiricorum jonstonii Kalenicz., Mosc. Bull., 1851, p. 113.
Arion empiricorum lamarckii Kalenicz., op. cit., p. 113.
Arion rufus α *vulgaris* Moquin-Tandon, Hist. Moll. France, 1855, ii., p. 10, pl. 1, f. 1.
Arion rufus γ *ruber* Moquin-Tandon, op. cit., pl. 1, f. 21.
Arion rufus ε *draparnaudi* Moquin-Tandon, op. cit., pl. 1, f. 23.
Arion servainiana Mabille, Ann. Malac., 1870, p. 109.
Arion rufus 4° *rufula* Baudon, Mém. Limaciens de l'Oise, 1871, p. 4.

ANIMAL red or reddish, usually of a ferrugineous tint, with generally a paler and brighter fringe.

The sub-vars. **jonstonii, vulgaris,** and **servainiana** are described as rufous and are synonymous with the typical *rufa*.

The sub-var. **rufula** is pale rufous, and is in part the var. *pallescens* Moq.-Tand.

The sub-vars. **coccinea, lamarckii,** and **rubra** have all been described as bright vermilion or deep red, and are adopted in that sense.

The sub-var. **draparnaudi** is deep red with a yellow foot-fringe.

The sub-var. **nigrescens** Raz. is of deep red-brown, with red foot-fringe.

This variety is the prevalent form in the dry and warm regions of Central Europe, where it frequently attains a great size and a brilliant colour, far surpassing the comparatively small and dull-coloured examples of our own country. The var. *rufa* usually occupies the plains and the lower mountain slopes, seldom ascending above an altitude of 3,000 feet, while the black variety is most common in the outlying countries, and also ascends to much higher elevations on the mountains.

ENGLAND AND WALES.

Channel Isles—Saint's Bay, Guernsey (Tomlin & Marquand, J. of Conch., Jan. 1903, p. 287). Fermain Bay, Guernsey, and on Sark, July 1886, B. Tomlin.

Devon S.—Culverhole, Aug. 1892, L. E. Adams.

Devon N.—Var. *rufa-fasciata*, Okehampton, Sept. 1904! Rev. W. W. Mason.

Hants. S.—Frequent near Christchurch, 1886, C. Ashford.

Hants. N.—Preston Candover, April 1884! Rev. H. P. Fitzgerald.

Kent E.—Sub-var. *rubra*, Shepherdswell, Aug. 1896! L. E. Adams.

Kent W.—St. Mary Cray, July 1883 (Cockerell, N.H. Notes, 1883, p. 124).

Middlesex—Sub-var. *draparnaudi*, Highgate, June 1888! H. Wallis Kew.

Suffolk E.—Needham Market (A. Mayfield, J. of Conch., April 1903, p. 295). Blaxhall, July 1885! G. T. Rope.

Norfolk E.—A sub-var. with scarlet foot-fringe common at Strumpshaw Hall, July 1904! W. J. O. Holmes.

Norfolk W.—King's Lynn, 1894, T. Petch.

Hereford—Not infrequent (Boycott and Bowell, Moll. Hereford, 1899).

Stafford—Cheadle (Masefield, Staff. List, 1902). Sub-var. *draparnaudi*, near Hartington, April 1890! L. E. Adams.

Salop—Minsterley, May 1887! L. E. Adams.

Glamorgan—Llandaff, July 1885! F. W. Wotton.

Pembroke—Near Pembroke, June 1885! Mrs. Trayler.

Carnarvon—Sub-var. *rufula*, Bettws-y-Coed, Aug. 1865, C. Ashford.

Lincoln N.—Maltby Wood near Louth, Aug. 1888! H. Wallis Kew.

Notts.—Cleveland Hill, West Markham, April 1884! C. T. Musson. Stanton-on-the-Wolds, E. J. Lowe. Wood, Ossington (Gain, Brit. Nat., Nov. 1893, p. 224). Hunger Hill Gardens, Nottingham (Dodd, Notts. List, 1893, p. 71).

Cheshire—Marple, Sept. 1888 ! Charles Oldham.

Lancashire S.—Between Liverpool and Warrington, Sep. 1885, T. D. A. Cockerell. Sub-var. *rubra*, Knowsley nr. Liverpool, 1893 (Collinge, J. of Mal., June 1893, p. 148).

York N.E.—High Cliff, Guisborough (Baker Hudson, J. of Conch., April 1886). Middlesbrough (id., Science Gossip, March 1885, p. 67).

York S.W.—Wakefield district, frequent (G. Roberts, Hist. of Lofthouse, 1885, ii., p. 238). Nab Wood near Saltaire (Soppitt & Carter, Nat., 1888, p. 97).

York Mid W.—Washburndale, July 1885 ! W. D. Roebuck. Knaresborough (Fitzgerald, J. of C., Jan. 1889). Overton Wood, York (Christy, Zool., 1881, p. 242).

SCOTLAND.

Ayr—Sub-var. *nigrescens* Raz., Cumnock (Rev. J. McMurtrie, J. of C., Apr. 1883).

Lanark—Sub-var. *nigrescens* Raz., Wishaw (Rev. J. McMurtrie, J. of C., Apr. 1883).

Orkneys—Var. *jonstonii*, Castle Green, Sanday (Collinge, J. of Mal., 1897, p. 43).

IRELAND.

Antrim—Sub-var. *nigrescens* Raz., common all round the Antrim coast ; Cave Hill Quarries, 1893 ; Murlough Bay, 1894 ; Brown's Bay, 1899, R. Welch.

Down—Sub-var. *nigrescens* Raz., Loughislandreavy, Oct. 1897 ; Union Locks, 1899, R. Welch.

Donegal—Sub-var. *nigrescens* Raz., Ardara Woods, 1900, R. Welch.

Cavan—Cavan, Sept. 1904 ! James M. Welch.

Meath—Sub-var. *nigrescens* Raz., Cairns on Loughcrew Hills, July 1900, R. Welch.

Dublin—Sub-var. *rufula*, Leeson Park, Dublin, Aug. 1894, R. F. Scharff.

Galway W.—Sub-var. *rufula*, Aran Isles, R. F. Scharff.

Tipperary S.—Sub-var. *nigrescens* Raz., Clonmel, Oct. 1904 ! Mrs. Malcolmson.

Waterford—Sub-v. *draparnaudi*, Mountain rd., Clonmel, Apl. 1888, A. H. Delap.

Kerry—Var. *rufa*, Valentia Island, May 1890, R. F. Scharff. Killflynn, Sep. 1904 ! J. Julian. Var. *rufa* and sub-var. *draparnaudi*, Gt. Skellig, Apl. 1888, A. H. Delap.

CONTINENTAL AND GENERAL DISTRIBUTION.

Germany—Distributed throughout the country, records having been noted for Alsace, Baden, Bavaria, Brandenburg, Cassel, East Prussia, Hanover, Holstein, Lauenberg, Mecklenburg, Nassau, Pomerania, Prussia, Reuss, Rhenish Prussia, Saxony, Schleswig, Silesia, Westphalia, and Wurtemburg.

Belgium—Recorded from Antwerp, Hainault, Liége, Luxembourg, Namur, and West Flanders. Sub-v. *vulgaris*, Vielsalm, 1867 (Colbeau, Bull. Mal. Soc. Belg., 1867).

France—The var. *rufa* is found throughout France, and has been recorded from the departments of the Ain, Aisne, Ariége, Aude, Basses Pyrénées, Charente Inferiéure, Côte-d'Or, Finistère, Gard, Gironde, Haute Garonne, Haute Loire, Hautes Pyrénées, Haute Savoie, Ille-et-Vilaine, Isére, Loire Inferiéure, Lot-et-Garonne, Manche, Maine-et-Loire, Morbihan, Moselle, Nord, Oise, Pas-de-Calais, Puy-de-Dôme, Pyrénées-Orientales, Savoie, Seine Inferiéure, Seine et Marne, Vendée, Vienne, and the Isle of Corsica. The sub-var. *rufula* is found in the forest of Hez, Oise ; the sub-var. *rubra* in the same department, growing to an enormous size at Noailles ; the sub-var. *nigrescens* Raz., is found at Aix-les-Bains, Savoy ; the sub-var. *servainiana* in the great forests of the Aisne ; the sub-var. *draparnaudi* is found in the Somme, while the sub-vars. *draparnaudi*, *marginella*, and *rubra* are all common in the Ain, the Rhone, the Seine, and Haute Loire.

Switzerland—Plentiful in Neuchâtel and Zurich, also at Bex and Vevey in Vaud. Sub-var. *draparnaudi*, Maderaner-Thal, Canton Uri, Mrs. Manville Fenn.

Italy—In Lombardy, the var. *rufa* is recorded from gardens and cultivated land in Comasco and Bresciana, and as been found on Monte Codeno, at about 5,000 feet altitude. It has also been found near Menaggio by Brockton Tomlin. In Piedmont it is recorded from the banks of the River Po. In Venetia from about Friuli. In Emilia from Reggio and Modena. In Tuscany from Pieve Fosciana near Lucca, and Bagni di Lucca, and is also recorded from Campania, at Naples, by Costa.

According, however, to Pollonera, this species is not found naturally in Italy, but has been artificially transplanted into the Royal Park at Monza, and from thence to the banks of the Gravellone near Pavia in Lombardy ; other records are unreliable, probably due to erroneous identification.

Spain—Noguera-Pallaresa, Catalonia (Fagot, Faun. Catal., 1884, p. 170). Sub-vars. *vulgaris* and *draparnaudi*, Galicia (Hidalgo, Hojas Malacológicas, 1870).

Norway—Sub-vars. *vulgaris* and *rufa* from Sverresborg, Bergen, and Christiania.

Sweden—Nilsson says in shady woods; found near Gothenburg by Malm.

Russia—The sub-var. *jonstonii* is recorded by Kaleniczenko for Wolczansk, Kupiansk, and Wulki in Kharkov ; and sub-var. *lamarckii* from Achtyrka, Lebedin, and Zmiew in the same district, but according to Dr. Simroth, erroneously.

Algeria—*Arion rufus* is recorded by Aucapitaine as rare on the trunks of old fig trees in spring, at Thaguemoun'th-ih'addaden, also at Beni Raten, and on the road to Medeah. The examples are more probably *A. subfuscus* or some allied species.

Azores—The *A. rufus* recorded by Morelet is according to Simroth *A. lusitanicus*.

Var. **succinea** Müller, Verm. Hist., 1774, p. 7, no. 203.

Limax succineus Muller, op. cit.
Limax luteus Razoumowsky, Hist. Nat. Jorat, 1789, p. 269.
Arion empiricorum var. *flavescens* Fér., Tabl., Syst., 1819, p. 18.
Arion melanocephalus Fér., op. cit.
Arion empiricorum schrauckii Kalenicz., Bull. Mosc., 1851, p. 114.
Arion rufus δ *succineus* Moq.-Tand., Hist. Moll. France, 1855, ii., p. 10, pl. 1, f. 22.
Arion rufus var. *aurantia* Baudon, Nouv. Cat. Moll. Oise, 1862.
Arion rufus var. *livida* Colb., Ann. Soc. Mal. Belg., 1865, p. 32.
Arion ater var. *pallescens* Williams, Shell Collectors' Handbook, 1888, p. 85.

ANIMAL yellow or yellowish, foot-fringe usually orange or red.

Müller's original description is "*rufo fuscus vel succini coloris*," but the name is here restricted to the yellow forms.

This variation is usually found only in young or half-grown individuals, but occasionally this juvenile colouration persists to adult life.

The sub-var. **melanocephala** differs from the type by the head and tentacles being obscure or blackish.

The sub-var. **aurantia** has the body of an orange colour.

The sub-var. **livida** has the body of a livid yellow colour, tinged greenish-grey especially on the back, foot-fringe orange, sole yellowish-grey.

The sub-var. **pallescens** Williams, is pale yellow and is the var. *luteo-pallescens* of Cockerell and in part the var. *pallescens* of Moquin-Tandon.

ENGLAND AND WALES.

Cornwall W.—Rewggan near St. Columb, May 1885 ! W. Vinson.

Devon N.—Var. *succinea* and sub-var. *livida*, Belstone, Okehampton, Sept. 1904 ! Miss Daisy Mason.

Somerset S.—Bridgwater, Sept. 1884 ! W. Vinson.

Hants. S.—Charlton, July 1884 ! W. Jeffery. Sub-var. *melanocephala*, Bitterne, July 1884 ! Rev. H. P. Fitzgerald.

Hants. N.—Sub-var. *luteo-pallescens*, Preston Candover, Oct., 1886 ! Rev. H. P. Fitzgerald.

Surrey—Sub-var. *melanocephala*, nr. Warlingham, July 1883, T. D. A. Cockerell.

Essex N.—Sub-var. *livida*, Manningtree, July 1904 ! Rev. Proctor Benwell.

Middlesex—Churchyard Bottom Wood, Highgate, April 1889 ! H. W. Kew.

Berks.—Sub-var. *melanocephala*, Maidenhead, Lionel E. Adams.

Gloucester W.—Stroud, Oct. 1883 ! E. J. Elliott.

Hereford—Sub-var. *livida*, Ross, Sept. 1904 ! W. Blake.

Salop—Sub-var. *luteo-pallescens*, Oswestry, June 1885 ! Baker Hudson.

Glamorgan—Parkmill, Gower, 1901, H. Rowland Wakefield.

Pembroke—Near Pembroke, June 1885 ! Mrs. Trayler.

Cardigan—Garden, Aberayron, June 1888 ! Miss Maddy.

Merioneth—Sub-var. *luteo-pallescens*, common in the county, Lionel E. Adams.

Carnarvon—Bettws-y-Coed, Aug. 1865, C. Ashford. Sub-var. *melanocephala*, Conway Castle, June 1888 ! W. Whitwell.

Lincoln N.—Haugham Wood near Louth, April 1886 ! W. Denison Roebuck.

Notts.—Meadows below Highfield House, Nottingham, E. J. Lowe, 1885. Sub-var. *melanocephala*, Cresswell Crags and Pleasley Vale, April 1884 ! C. T. Musson.

Cheshire—Ringway near Bowdon, July 1885 ! J. G. Milne. Sub-var. *luteo-pallescens*, Romiley, Oct. 1886 ! C. Oldham.

Lancashire S.—Sub-var. *luteo-pallescens*, Whalley and Farington, June 1890 ! W. H. Heathcote.

York N.E.—Farwath Bridge, Aug. 1886 ! and Skelton Beck Valley, Saltburn, also sub-var. *luteo-pallescens*, Wilton Wood, May 1887 ! W. Denison Roebuck.

York Mid W.—Meanwood Wood, Leeds, Aug. 1882 ! W. Denison Roebuck. Sub-var. *luteo-pallescens*, Armley, April 1890 ! Lionel E. Adams.

York N.W.—Satron and Angram, July 1884 ! also Storthwaite in Arkengarthdale, Aug. 1885 ! W. Denison Roebuck.

Durham—Sub-var. *aurantia*, Durham ! W. D. Roebuck, Nat., July 1889, p. 212. Sub-var. *luteo-pallescens*, Middleton-in-Teesdale, Aug. 1889 ! Rev. E. P. Knubley.

Westmorland—Sub-var. *melanocephala*, Orrest Head, June 1902 ! C. Oldham.

Cumberland—Sub-var. *livida*, Brigham, Cockermouth, Sep. 1904 ! Mrs. Robinson.

Isle of Man—Port Erin and Ramsey, 1881, L. E. Adams. Sub-var. *melanocephala*, Douglas, Sep. 1902 ! F. Taylor. Sub-var. *luteo-pallescens*, Peel, Aug. 1894, R. Cairns.

SCOTLAND.

Ayr—Skelmorlie, Aug. 1886 ! W. Denison Roebuck. Maybole ! W. Evans.

Peebles—Sub-var. *luteo-pallescens*, Riddenlees and Leadburn, July 1889 ! W. D. Roebuck.

Berwick—Sub-var. *luteo-pallescens*, Cowdenknowes, and Pease Dean near Cockburnspath, Aug. 1886 ! W. Denison Roebuck.

Stirling—Sub-var. *luteo-pallescens*, Balmore, Sept. 1888 ! A. Shaw.

Dumbarton—Garscadden, June 1889 ! A. Shaw.

IRELAND.

Antrim—Cave Hill, Belfast, March 1884 ! S. A. Stewart. Dunluce Castle, Dec. 1883, L. E. Adams. Sub-var. *luteo-pallescens*, Cushendun, May 1886 ! S. A. Brenan.

Armagh—Sub-var. *luteo-pallescens*, Armagh, June 1885 ! Rev. H. W. Lett.

Donegal—Sub-var. *luteo-pallescens*, Letterkenny, May 1889 ! H. C. Hart.

Louth—Sub-var. *livida*, near Drogheda, Oct. 1904 ! P. H. Grierson.

Dublin—Sub-vars. *aurantia* and *luteo-pallescens*, common by road-sides, Donnybrook, Aug. 1888 ! G. A. Barrett-Hamilton.

Kildare—Maynooth, Nov. 1891, R. F. Scharff.

Wicklow—Sub-var. *livida*, with perceptible lateral banding, Enniskerry, Aug. 1904 ! P. H. Grierson.

Wexford—A yellowish fawn-coloured var. at Wexford, Sept. 1890 ! R. F. Scharff.

Carlow—Fenagh House, Bagenalstown, Sept. 1904 ! D. R. Pack-Beresford.

Mayo W.—Sub-var. *aurantia*, with faint lateral bands, Enniscoe demesne, Crossmolina, Sept. 1885 ! W. F. de Vismes Kane.

Clare—Sub-var. *livida*, Woodpark, Scariff, Sept. 1904 ! N. F. Hibbert.

Tipperary S.—Melview, Clonmel, Oct. 1904 ! Mrs. Malcolmson.

Cork N.—Youghal (Humphreys, Fauna and Flora of Cork, 1845, p. 2). Var. *succinea* and sub-var. *livida*, near Cork, Sept. 1904 ! C. Baker.

Kerry—Sub-var. *luteo-pallescens*, Killflynn, Sept. 1904 ! J. Julian.

CONTINENTAL DISTRIBUTION.

Belgium—Sub-var. *livida*, Trooz near Liége. Sub-var. *pallescens*, Chaudfontaine and Stoumont (Colbeau, op. cit.).

France—This variety has been reported from the Cantal, Côte d'Or, Haute Loire, Maine-et-Loire, Morbihan, Oise, Puy-de-Dôme, Rhone, Seine, Somme, and Vosges.

Switzerland—A yellowish-fawn coloured variety, with red foot-fringe, common at Engelberg in Canton Unterwalden, and Sonnenberg in Canton Lucerne, July 1904 !

Spain—Galicia (Macho t. Hidalgo, Hojas Malacológicas, 1870).

Russia—Recorded by Kaleniczenko as var. *schranckii* for Achtyrka, Lebedin, and Zmiew, in the government of Kharkov, but according to Simroth in error.

Var. **alba** L., Syst. Nat., ed. xii., 1767, p. 1081, no. 2.

Limax albus margine luteo Müller, Esterr. om Swamp., 1763, p. 61.
Limax albus L., op. cit.
Arion albus Fér., Hist. Moll., 1819, p. 64, pl. 2, f. 3.
Arion albus var. *simplex* Moquin-Tandon, Hist. Moll. France, 1855, ii., p. 12.
Arion albus var. *marginatus* Moquin-Tandon, op. cit.
Arion albus var. *oculatus* Moquin-Tandon, op. cit.
Arion albus var. *elegans* Moquin-Tandon, op. cit.
Arion ater var. *cinereo-nebulosus* Jensen, Indberetning, 1872.
Arion ater var. *albida* Roebuck, J. of Conch., 1883, iv., p. 40.
Lochea alba Malm, Skand. Land Snigl., 1878, p. 37, pl. 1, f. 2.

Body white or whitish, with or without yellow foot-fringe, and perceptible pigmented lineolation.

The sub-var. **simplex** is uniformly white or whitish.

The sub-vars. **marginata** and **albida** are white or whitish with yellow foot-fringe, and are also in part the var. *pallescens* of Moquin-Tandon.

The sub-var. **elegans** is white or whitish with orange head and foot-fringe.

The sub-var. **oculata** is white or whitish with black tentacles.

The sub-var. **cinereo-nebulosa** is whitish dorsally, with obscure cinereous spots on the sides of the body and sole, foot-fringe yellow. It forms an interesting connecting link with the var. *bocagei* through the var. *glauca*.

This variety, according to Leach, is chiefly found in chalky districts, while Dumont and Mortillet believe it to be due to living in very shady forests. The variation is usually pathological, being really due to a deficiency of secretory power, but is sometimes found in young specimens in which that function is as yet undeveloped, and is a condition liable to occur wherever the species is found; but the real cause of the deficiency is still obscure, though Gredler states that the prevalence of the albine form is often an indication that the species has reached the limit of its horizontal or vertical distribution.

ENGLAND AND WALES.

Devon N.—Ilfracombe, Aug. 1903 (Beeston and Wright, J. of C., July 1904, p. 73).

Dorset—Sub-var. *marginata*, Chideock, Bridport, Aug. 1885 ! A. Belt.

Kent W.—Sub-var. *marginata*, Dartford, J. E. Gray (Leach, Syn., 1852, p. 49). North Downs near Harrietsham, June 1897 ! Henry Lamb.

Herts.—Sub-var. *marginata*, Rickmansworth, Sept. 1895 ! J. T. Carrington. Gardens, Watford, J. Hopkinson, Trans. Herts. N.H. Soc., 1884, p. 27.

Berks.—Sub-var. *oculata*, Maidenhead, June 1880, L. E. Adams.

Northampton—Haselbeech, Rev. W. A. Shaw.

Gloucester E.—Sub-var. *marginata*, Dowdeswell wood, Cheltenham, June 1885 ! E. D. Marquand.

Monmouth—Sub-var. *oculata*, Chepstow, Aug. 1886 ! J. Madison.

Hereford—Cream coloured specimens used to be common on the canal-side near Holmer (Boycott and Bowell, Hereford List, 1899).

Warwick—Sub-var. *marginata*, Sutton Coldfield, H. Overton.

Stafford—Sub-var. *marginata*, Trentham, Allen Howe (Masefield's Staffordshire List, 1902).

Salop—Sub-var. *albida*, Oswestry, June 1885 ! Baker Hudson.

Denbigh—Sub-var. *marginata*, Llangwystenin, July 1883 ! W. Denison Roebuck.

Lancashire S.—Sub-var. *marginata*, Whalley, Sept. 1886 ! C. Oldham.

York Mid W.—Sub-var. *marginata*, Hawkesworth wood, Horsforth, June 1892 ! Horton-in-Ribblesdale, 1892 ! W. Denison Roebuck.

Westmorland and Lake Lancashire—Type of sub-var. *albida*, Ambleside, June 1882 ! Rev. J. McMurtrie. Sub-var. *oculata*, Grange, July 1904 ! W. J. Davey. Ulverston, Aug. 1903 ! S. Lister Petty.

Isle of Man—Sub-var. *marginata*, Onchan, Aug. 1894, F. Taylor ; and Port Erin, 1902, H. Overton.

SCOTLAND.

Lanark—Sub-var. *marginata*, Uddingston, June 1889 ! A. Shaw.

Selkirk—Sub-var. *elegans*, Thornielee station-yard, Aug. 1886 ! W. D. Roebuck.

Kincardine—North Esk near Morphie, May 1891 ! W. Duncan.

IRELAND.

Derry—Common about Coleraine, 1883, L. E. Adams.

Down—Sub-var. *marginata*, Loughbrickland, June 1886 ! Rev. H. W. Lett.

Louth—Sub-var. *oculata*, Carlingford, Dec. 1904 ! P. H. Grierson.

Dublin—Sub-var. *marginata*, Rathmines, April 1887 ! R. F. Scharff.

Meath—Sub-vars. *simplex* and *marginata*, Slane, July 1904 ! P. H. Grierson.

Roscommon—Mote Park, Sept. 1904 ! Lord Crofton.

Tipperary S.—Melview, Clonmel, Oct. 1904 ! Mrs. Malcolmson.

CONTINENTAL DISTRIBUTION.

Germany—The var. *alba* has been recorded from Baden, Lausitz, Nassau, Prussia, Saxony, and Silesia. The sub-var. *simplex* from Silesia and Hesse Cassel.

Belgium—Var. *alba* enumerated by Colbeau for Belgium.

Holland—Cited for North Holland by von Martens.

France—The var. *alba* is distributed through East and West France, the Alps, and Pyrénées, and has been recorded for Hautes-Pyrénées, the Alps of Dauphiny, Finistère, Lille in the Nord, the mountain-forest of Faucigny in Savoy, and Pas-de-Calais. Sub-vars. *oculata*, *elegans*, *simplex*, and *marginata* are enumerated as French by Moquin-Tandon.

Switzerland—Recorded by Charpentier as moderately rare at Sollalex and the Finshauts in the Valais.

Norway—Not so common as the black variety ; it has, however, been recorded from the Isle of Haaöen in the Gulf of Christiania ; also from Modum, Tonsberg, Laurvik, Asker, Skien, Bergen, and as far north as Trömsdalen in Arctic Norway, and in **Iceland**. The sub-var. *cinereo-nebulosa*, Naes (Westerlund, Syn. Moll. Extram. Skand., 1897, p. 39).

Sweden—The var. *alba* is recorded from Blekinge, Bohusland, Christianstad, and Fröllinge in Halland ; Göteberg, Nerike, Westergötland, Westmanland, and the neighbourhood of Stockholm ; sub-vars. *marginata* and *simplex* at Fröllinge in Halland ; and sub-var. *oculata* at Esperöd, in Scania, all rarely.

Denmark—Environs of Harbourg, Friedrichsdal, and Copenhagen in Zealand, also in Jutland, and the Isle of Bornholm.

Russia—Var. *alba*, frequent in shady woods in Tchernigov ; sub-vars. *marginata* and *simplex*, at Achtyrka ; and sub-var. *oculata*, at Bogoduchow in Kharkov, all recorded by Kaleniczenko, but according to Dr. Simroth incorrectly.

VARIATIONS IN COLOUR AND MARKINGS OF ANIMAL.

Var. **bocagei** Simroth, Zool. Anz., 1888, no. 272.

Arion rufus var. *glauca* Colbeau, Bull. Soc. Mal. Belg., 1867, p. 46.

ANIMAL uniformly white, except the foot-sole, which is black.

The young are of a lively red, the head somewhat lilac, and the foot pale, later the dorsum becomes whitish, changing to blackish-brown towards the sole, which is fairly dark ; as they reach the adolescent stage the back becomes whiter, the whiteness extending towards the sole, which becomes darker, a phase figured by Simroth (Nacktschn. Portug.-Azor. Faun., 1891, pl. 13, f. 1) ; it is only when fully adult that the animal assumes the almost uniformly white body and black foot-sole.

The sub-var. **glauca** is greenish-white, with greyish sides, foot-sole blackish-grey, head, neck, and tentacles purplish-black, and though verified by Colbeau as a young stage of *rufa* is almost identical with the immature stage of the true *bocagei*.

Under the name of *bocagei*, various forms have been recorded as British which have little or no relation with that variety.

Belgium—Sub-var. *glauca*, Forest of Soigne, and a few other places.

Portugal—Var. *bocagei*, Las Caldas do Gerez in Minho (Simroth, op. cit., 1891).

Var. **albolateralis** Roebuck, Journ. of Conch., 1883, p. 39.

Arion empiricorum var. *medius* Jensen, Indberetning, 1872.

ANIMAL black, sides quite white, the two colours being sharply defined ; foot pale, with orange fringe.

Sub-var. **media** has a black dorsum and white sides, with an intermediate pale-brown area, which extends over the front and sides of the shield, and is tentatively placed here, though Prof. Cockerell regards it as probably a variety of *A. subfuscus*.

This var. *albolateralis* is restricted to the north and west of the British Isles. Simroth, however, speaks of a black and white variety from Bremen.

ENGLAND AND WALES.

Cornwall W.—A sub-var. with grey foot-fringe at Penzance, Sept. 1885 ! E. D. Marquand. Falmouth, a specimen in British Museum, T. D. A. Cockerell, Sept. 1884.

Cornwall E.—Abundant on Queen's Hill, St. Columb, June 1885 ! Wm. Vinson. St. Austell, Sept. 1904 ! C. P. Richards.

Devon S.—Topsham, Aug. 1892, L. E. Adams.

Wilts. S.—Salisbury, Aug. 1904 ! A. D. R. Bacchus.

Dorset—Chideock, Bridport, Aug. 1885 ! A. Belt. Abbotsbury, May 1889 ! W. Whitwell. Old British Camp, Charminster, Aug. 1889 ! T. F. Burrows. Maiden Castle, T. F. Brown (Mansel-Pleydell, Moll. Dorset, 1898, p. 5).

Sussex W.—Singleton, not very characteristic, July 1884 ! W. Jeffery.

Kent E.—A colony at Kingsdown, Sept. 1891 ! L. E. Adams.

Gloucester E.—Leckhampton, June 1885 ! J. Madison.

Monmouth—Shirenewton, July 1890 ! E. J. Lowe.

Stafford—Stafford, 1886 ! L. E. Adams.

Salop—Minsterley, May 1887 ! L. E. Adams. Oswestry, June 1885 ! B. Hudson.

Cardigan—Aberystwyth, May 1888 ! E. Collier.

Montgomery—Timber-yard, Welshpool, June 1889 ! J. Bickerton Morgan.

Merioneth—Nant-y-Mor, June 1901 ! W. Denison Roebuck. Bont ddu near Dolgelly, and slopes of Cader Idris, July 1886 ! F. G. Fenn.

Carnarvon—Bettws-y-Coed. Aug. 1865, C. Ashford. Dinas station ! and abundant at Trefriw, July 1883 ! W. Denison Roebuck.

Anglesea—Llanfaes, Sept. 1886 ! J. G. Milne.

York S.W.—Hedon, April 1904, and Danes Dyke, T. Petch.

Northumberland—River side, West Woodburn, Sept. 1886 ! R. Howse.

Westmorland and Lake Lancashire—Hill Fell, May 1885 ! W. West. Coniston, April 1887 ! S. C. Cockerell. Greenodd near Ulverston, Sept. 1904 ! S. Lister Petty.

Isle of Man—Bradda Head, 1880, L. E. Adams. Kirk Braddan and Onchan, Aug. 1885 (J. Moore, Sci. Goss., April 1886, p. 94). Port Erin, 1902, H. Overton.

SCOTLAND.

Sutherland E.—Golspie Burn, June 1884 ! W. Baillie.

IRELAND.

Antrim—Whitehall, Broughshane, June 1886 ! Rev. S. A. Brenan. Island Magee, June 1903, R. Patten.

Meath—Slane, July 1904 ! P. H. Grierson.

Galway W.—Aran Isles, July 1895 (R. Standen, Irish Nat., Sept. 1895).

CONTINENTAL DISTRIBUTION.

Norway—Sub-var. *media*, Bergen (Miss Esmark, J. of Conch., Oct. 1886).

Var. **bicolor** Roebuck, not of Moq.-Tand., Hist. Moll. France, 1855, p. 11.

Arion ater var. *elincolatus* Cockerell, Science Gossip, Nov. 1886, p. 259.
Arion ater var. *scharffi* Cockerell, Journ. of Mal., 1893, p. 208.

ANIMAL deep brown, with sides of body yellowish or orange.

The sub-var. **scharffi** differs in the back being black instead of deep brown, sides yellow, and according to Prof. Cockerell his var. *elincolata* is almost identical.

The *Arion rufus* var. *bicolor* of Moquin-Tandon, judging by figs. 6, 7, on plate 1 of Férussac's work, which he cites as representing his form, is not this species, but *Arion subfuscus*. Mr. Roebuck first correctly used the name *bicolor* in connection with the present species.

Like the var. *albolateralis*, this variety would seem in this country to be strictly western in its distribution, while Dr. Scharff has expressed the opinion that, according to his experience in Ireland, it is a strictly littoral form in that country, and states that Simroth has found similar specimens on the shores of the Baltic Sea.

ENGLAND AND WALES.

Cornwall W.—On heath, near Bodmin (Leach, Syn., 1852, p. 49). Scilly Isles, Aug. 1896 ! Rev. E. D. Roberts. Phillack near Hayle, Oct. 1884 ! S. Hockin. Trevidock road, St. Columb, May 1885 ! W. Vinson. Sub-var. *elincolata*, Truro, J. H. James (Cockerell, Science Gossip, l.c.).

Cornwall E.—Garden-bank, St. Columb, May 1885 ! W. Vinson.

Devon S.—Topsham, Aug. 1892 ! Lionel E. Adams.

Devon N.—Clovelly 1898 (W. E. Collinge, J. of Mal., 1898, p. 17). Lynton, 1898, F. J. Partridge (J. of Mal., 1898, p. 19).

Dorset—Bridport, Aug. 1885 ! A. Belt.

Gloucester E.—Between Chalford and Sapperton, Sept. 1884 ! E. J. Elliott. Cheltenham, Aug. 1892, L. E. Adams.

Gloucester W.—The usual form in the valley between Chalford and Sapperton, Sept. 1884 ! also found at Brimscombe, May 1884 ! E. J. Elliott.

Monmouth—Shirenewton Hall, May 1889 ! E. J. Lowe.

Stafford—In dingle near Stafford, Oct. 1885 ! L. E. Adams.

Lincoln N.—Louth, amongst *Tussilago farfara*, 1885, H. Wallis Kew.

Notts.—Embankment, Colwick station, Sept. 1884 ! C. T. Musson. East Markham (W. A. Gain, Brit. Nat., Nov. 1893, p. 224).

Denbigh—Lower slopes of Cader Idris, July 1886 (Fenn, J. of Conch., July 1887).

Lancashire S.—Knowsley near Liverpool, 1893 (Collinge, J. of Mal., 1893, p. 148).

Isle of Man—Castletown and Peel, Aug. 1894 ! R. Cairns. Douglas, April 1904 (B. R. Lucas, J. of Conch., 1904, p. 90). Ramsay, Aug. 1894 ! F. Taylor.

IRELAND.

Antrim—Broughshane, 1886 ! Rev. S. A. Brenan. Kenbane Port, 1901, R. Welch.

Meath—Navan, July 1888, R. F. Scharff. Common, Ardbraccan Graveyard, July 1900, R. Welch.

Dublin—Near Dublin, March 1886 ! J. R. Redding. Howth, June 1890 ! W. F. de Vismes Kane. Garden, Rathmines, A. G. More (Scharff, Slugs of Ireland, 1891, p. 540). Var. *scharffi*, common at Raheny (T. D. A. Cockerell, J. of Mal., 1893, p. 208).

Waterford—Several in a small bog, Ballygunner, Sept. 1883 ! J. H. Salter. Blenheim, Sept. 1889 ! Miss Glascott.

Galway W.—Clare-Galway Abbey, July 1895 (R. Standen, Irish Nat., Sep. 1895).

Cork S.—Glengariff, Sept. 1898, L. E. Adams. Schull (Phillips, Moll. Cork, 1894).

Kerry—Kenmare, July 1898 (R. Standen, Irish Nat., Sept. 1898). Kenmare Woods near Hotel, 1898, R. Standen and R. Welch. Cloonee Lakes, 1898, E. Collier and R. Standen.

CONTINENTAL DISTRIBUTION.

Germany—Shores of Baltic Sea (Simroth t. Scharff).

Var. **reticulata** Roebuck, Journ. of Conch., Oct. 1885.

Arion ater var. *subreticulatus* Cockerell, Science Gossip, Nov. 1886, p. 259.

ANIMAL with rugæ dull yellow or dull white, with grey interstices, giving a beautifully reticulated appearance to the whole body ; the shield is uniformly grey, foot-fringe pale or dull tawny-orange with the usual black lineolation.

The sub-var. **subreticulatus** of Cockerell is less distinctly reticulated.

ENGLAND.

Cornwall W.—Sub-v. *subreticulata*, Truro, J. H. James (Cockerell, Sc. Goss., l.c.).

IRELAND.

Antrim—Murlough, May 1897, Lionel E. Adams.

Louth—Carlingford, Dec. 1904 ! P. H. Grierson.

Dublin—A sub-var. with deep black interstices, a blackish mid-dorsal line, and blackish shield, with indications of darker median and lateral-lines, was found at Howth, May 1892, R. F. Scharff.

Cork N.—Mallow, Nov. 1884 ! W. F. de Vismes Kane.

Var. **fasciata** Van den Broeck, Mem. Soc. Mal. Belg., 1869, p. 87.

Arion rufus var *fasciatus* Van den Broeck, Mem. Soc. Mal. Belg., 1869, p. 87.
Arion ater var. *subdeletus* Cockerell, Science Gossip, Aug. 1886, p. 187.
Arion ater var. *fasciata* Cockerell, Science Gossip, Feb. 1889, p. 44.

ANIMAL with a black or blackish lateral band on each side of the body and shield.

The sub-var. **subdeleta** is greenish or yellowish-grey, lateral banding brownish and very indistinct, head and tentacles blue-black.

This variation, which is an illustration of colour development arrested at the banded juvenile stage, is liable to occur in all the various ground colourings, but is more frequently met with in Ireland and other countries towards the limits of the distributional area of the species, than at or near the more active evolutionary centre, where the more uniform typical colouration of the body is more consistently and generally acquired.

ENGLAND AND WALES.

Cornwall W.—Sub-var. *plumbeo-fasciata*, St. Columb, May 1885 ! W. Vinson.

Kent E.—One specimen, sub-var. *brunneo-fasciata*, Dover, Ap. 1899, L. E. Adams.

Norfolk E.—Sub-var. *brunneo-fasciata*, Strumpshaw Hall, July 1904 ! W. J. O. Holmes.

Stafford—Sub-var. *brunneo-fasciata*, near Stafford, Aug. 1886 ! L. E. Adams.

Pembroke—Sub-v. *brunneo-fasciata*, North Cliff, Tenby, Feb. 1898 ! A. G. Stubbs.

Derby—One specimen, sub-v. *brunneo-fasciata*, Norbury, June 1897, L. E. Adams.

York S.W.—One specimen, sub-var. *brunneo-fasciata*, Penistone, L. E. Adams.

IRELAND.

Derry—Sub-var. *brunneo-fasciata*, Magilligan, Sept. 1904 ! J. N. Milne.

Antrim—Sub-var. *plumbeo-fasciata*, Broughshane, June 1886 ! Rev. S. A. Brenan.

Monaghan—Sub-vars. *brunneo-fasciata* and *nigrescens-fasciata*, Carrickmacross, July 1904 ! P. H. Grierson.

Meath—Sub-var. *brunneo-fasciata*, Drumcondra and Slane, July 1904 ! P. H. Grierson.

Dublin—Sub-var. *brunneo-fasciata*, Kill-of-the-Grange, April 1886 ! and Glen Druid, near Carrickmines, Oct. 1886 ! W. F. de Vismes Kane.

Wicklow—Sub-var. *lirida-fasciata*, Enniskerry, Aug. 1904 ! P. H. Grierson.

Leitrim—Sub-var. *brunneo-fasciata*, Swiss Valley, Glencar, July 1904 ! A. W. Stelfox ; and Mohill, July 1904 ! P. H. Grierson.

Mayo W.—Sub-var. *aurantia-fasciata*, Enniscoe Demesne, Sept. 1885 ! W. F. de Vismes Kane.

Tipperary N.—Sub-var. *brunneo-fasciata*, shores of Lough Derg, Sept. 1904 ! G. J. Fogerty.

Cork S.—Sub-var. *rufo-fasciata*, common at Glengariff, Sept. 1898, L. E. Adams.

CONTINENTAL DISTRIBUTION.

Belgium—Var. *rufo-fasciata*, Bel-Oeil, Hainault and Fond de Forêt near Liége.

Var. **marginella** Schranck, Fauna Boïca, 1803, p. 252, no. 3158.

Limax marginellus Schranck, op. cit.
Arion empiricorum swammerdamii Kalenicz., Bull. Mosc., 1851, t. xxiv., pt. ii., p. 113.
Arion empiricorum razoumowsksii Kalenicz., op. cit.
Arion rufus marginatus Moquin-Tandon, Hist. Moll., p. 11, pl. i, f. 24.
Arion rufus η *nigrescens* Moquin-Tandon, op. cit.
Arion ater var *griseo-marginata* Dum. & Mort., Cat. Moll. Savoie, 1857, p. 6.

ANIMAL with black body and shield, foot-fringe yellow or vermilion red.

The *Limax marginellus* Schranck, *Arion empiricorum swammerdamii* Kal., and *Arion rufus* var. *marginata* Moq., all conform to the varietal description.

The sub-vars. **nigrescens** Moquin-Tandon and **razoumowskii** Kal. appear identical, the body being blackish in colour, and the foot-fringe yellowish or reddish.

The sub-var. **griseo-marginata** has the foot-fringe greyish.

ENGLAND AND WALES.

Channel Isles—St. Sampson's, Guernsey (Tomlin and Marquand, J. of Conch., Jan. 1903, p. 287).

Cornwall W.—Trevidock road, St. Columb, May 1885 ! W. Vinson.

Cornwall E.—Sub-var. *nigrescens*, St. Columb, May 1885 ! W. Vinson.

Devon S.—Prince's Town, Dartmoor, July 1884 ! C. J. Waterfall.

Devon N.—Var. *marginella* and sub-var. *nigrescens*, Belstone near Okehampton, Sept. 1904 ! Rev. W. Wright Mason. Sub-var. *nigrescens*, Glenthorne, Sept. 1904 ! Mrs. Blundell.

Somerset S.—Sub-var. *nigrescens*, Bridgwater, Sept. 1884 ! W. Vinson.

Wilts. N.—Var. *marginella* and sub-var. *nigrescens*, Swindon (T. D. A. Cockerell, J. of Conch., July 1886, p. 83).

Dorset—Chideock, Bridport, Aug. 1885 ! A. Belt.

Kent W.—Sub-var. *nigrescens*, St. Mary Cray, Sept. 1884 ! T. D. A. Cockerell.

Herts.—Sub-var. *nigrescens*, Totteridge, May 1888 ! H. W. Kew.

Middlesex—Sub-var. *nigrescens*, Acton, Aug. 1884 ! and Bedford Park, Chiswick, Feb. 1885 ! T. D. A. Cockerell.

Monmouth—Sub-var. *nigrescens*, Talywain, July 1904 ! John Manners.

Stafford—Sub-var. *nigrescens*, Rowley Park, Stafford, May 1884 ! E. H. Wynne. Common about Stafford, June 1886 ! L. E. Adams. Ramsor, Feb. 1890 ! T. F. Burrows.

Salop—Oswestry, June 1885 ! B. Hudson. Sub-var. *nigrescens*, Llanforda and St. Oswald's Well, near Oswestry, June 1885 ! B. Hudson.

Glamorgan—Sub-var. *nigrescens*, banks of River Ely, St. Fagan's, March 1885 ! F. W. Wotton. Llandaff, etc. (id., J. of Conch., April 1886, p. 53).

Carmarthen—Near Llanelly, Oct. 1904 ! H. Rowland Wakefield.

Cardigan—Sub-var. *nigrescens*, Aberayron, June 1888 ! W. Whitwell.

Montgomery—Sub-var. *nigrescens*, Llanwddyn, May 1889 ! J. B. Morgan.

Merioneth—Sub-v. *nigrescens*, Barmouth, alt. 2,000 ft., Aug. 1884 ! J. Hopkinson.

Carnarvon—Sub-var. *nigrescens*, Snowdon, April 1887 ! J. Madison.

Lincoln N.—Sub-var. *nigrescens*, Louth, Oct. 1886 ! H. W. Kew. Cadney and Ancholme Bank, Aug. 1902 ! Rev. E. A. Woodruffe-Peacock.

Leicester—Oadby near Leicester, Sept. 1884 ! C. T. Musson. Sub-var. *nigrescens*, Market Harborough, June 1885 ! H. E. Quilter.

Notts.—Pleasley Vale ! Worksop ! and Cleveland Hill, West Markham, April 1884 ! also sub-var. *nigrescens*, Colwick, Sept. 1884 ! C. T. Musson. Garden at Tuxford, April 1885 ! W. A. Gain.

Derby—Markland Grip, April 1884 ! C. T. Musson. Sub-var. *nigrescens*, Darley Dale, June 1890 ! W. H. Heathcote.

Lancashire S.—Sub-var. *nigrescens*, Farington, June 1890 ! W. H. Heathcote.

York N.E.—Slater's Nurseries, Malton, July 1884 ! W. Denison Roebuck. Common about Guisborough, Marton, Thornaby, Upleatham, Middlesbrough, etc. (Baker Hudson, J. of Conch., April 1886, p. 48). Sub-var. *nigrescens*, Pickering Castle Hill, Aug. 1886 ! and Saltburn Cliffs, May 1887 ! W. Denison Roebuck.

York Mid W.—Sub-var. *nigrescens*, Bradley Hill, Kildwick, April 1884 ! and Canal bank, near Armley, Oct. 1884 ! W. Denison Roebuck.

York N.W.—Sub-var. *nigrescens*, Ivelet Bridge, July 1884 ! and about Gunnerside, July 1884 ! W. Denison Roebuck. Sleightholmedale, Aug. 1903 ! R. Gibbs.

Durham—Durham, Apl. 1885 ! High Force, June 1884 ! and Spa Wood, May 1887 ! B. Hudson. Sub-var. *nigrescens*, Langdon Beck, July 1884 ! W. Denison Roebuck.

Isle of Man—Douglas, Sept. 1892 ! F. Taylor.

SCOTLAND.

Roxburgh—Sub-var. *grisco-marginata*, Langlee, Sept. 1904 ! J. Roseburgh.

Berwick—Sub-var. *nigrescens*, Cockburnspath, Sept. 1890 ! W. Evans.

Edinburgh—Sub-var. *nigrescens*, Braidburn, July 1888 ! W. E. Clarke.

Forfar—Den of Airlie ! C. B. Plowright.

Aberdeen S.—Sub-var. *nigrescens*, Drum Woods, Deeside, Sept. 1886 ! C. B. Plowright ; and near Botanic Gardens, Old Aberdeen, Sept. 1904 ! G. Sim.

Dumbarton—Sub-var. *nigrescens*, Garscadden, June 1889 ! A. Shaw.

Clyde Isles—Sub-var. *nigrescens*, Loch Greenan, Aug. 1886 ! W. Denison Roebuck ; and at Rothesay, Isle of Bute ! T. Scott.

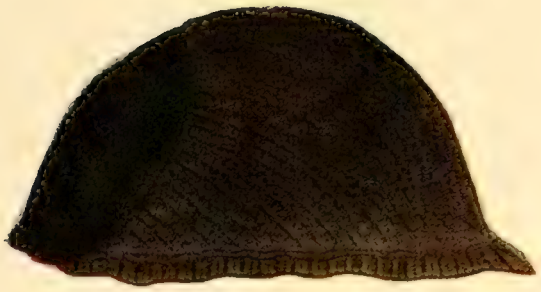
Cantire—Sub-var. *nigrescens*, Tarbert, April 1886 ! T. Scott.

Ebudes S.—Sub-var. *nigrescens*, near Port Charlotte, Islay, Nov. 1890 ! W. Evans.

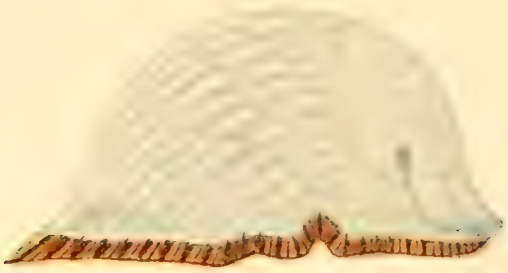
Sutherland E.—Loch Brora, June 1884 ! and the Blue Rock, Sept. 1884 ! W. Baillie.

Shetlands—Sub-var. *nigrescens*, Moss Bank, Sept. 1904 ! T. Bowie.

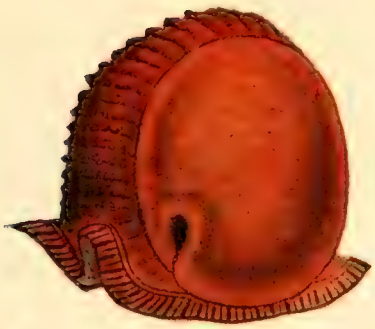
ARION ATER (L.).



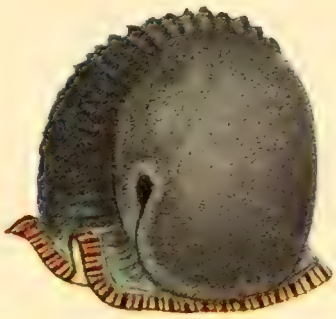
1. *Arion ater var. atra, p.* 175.
Barmouth, J. Hopkinson.



2. *Arion ater subvar. alba, p.* [illegible].
Ambleside, Rev. D. McMurtrie.

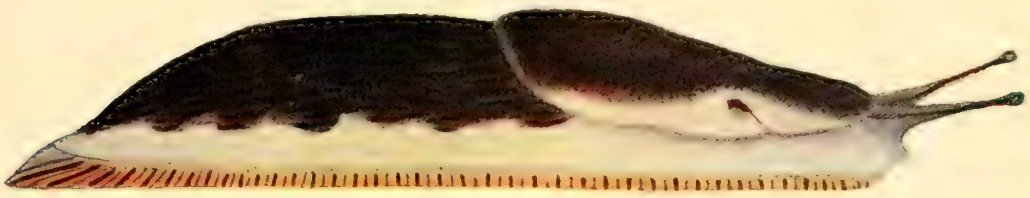


3. *A. ater subvar. rubra, p.* 180.
Shepherdswell, L. E. Adams.

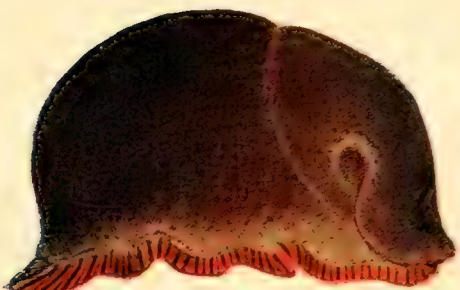


4. *A. ater var. plumbea, p.* 179.
St. Austell, C. P. Richards.

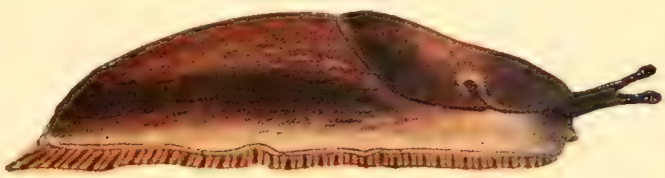
5. *A. ater var. succinea, p.* 18[illegible].
Near Bowden, J. G. Milne.



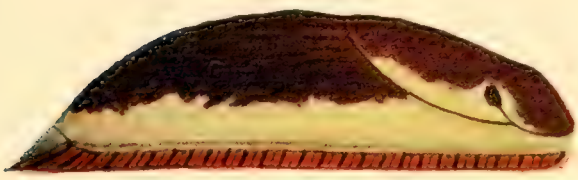
6. *Arion ater var. albolateralis, p.* 1[illegible]5.
Greenodd near Ulverston, S. Lister Petty.



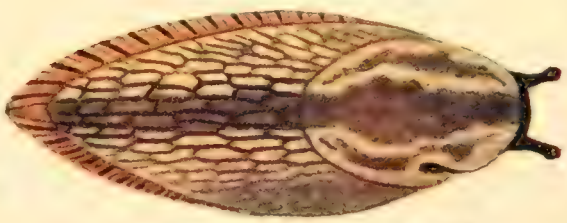
7. *Arion ater var. castanea, p.* 176.
Stratford St. Mary, G. T. Rope.



8. *Arion ater subvar. brunneo-fasciata, p.* 177.
North Cliff, Tenby, A. G. Stud[illegible].



9. *Arion ater var. bicolor, p.* 176.
Brimscombe, E. I. Elliott.



10. *Arion ater var. nigra, p.* [illegible].
Near Sidcup.

IRELAND.

Antrim—Sub-var. *nigrescens*, Colin Glen near Belfast, June 1884 ! S. A. Stewart.

Down—Sub-var. *nigrescens*, Slieve Donard, alt. 1,500 feet, Sept. 1884 ! and Newcastle, Oct. 1884 ! Rev. H. W. Lett.

Monaghan—Common in fields about Cremorne, Aug. 1805, Mr. Templeton (Thompson, Ann. Nat. Hist., 1840, p. 10). Sub-var. *nigrescens*, Carrickmacross, July 1904 ! P. H. Grierson.

Tyrone—Sub-var. *nigrescens*, Baronscourt, Sept. 1904 ! Robert Bell.

Fermanagh—Enniskillen, Sept. 1904 ! Dean of Clogher.

Dublin—Road-sides around Donnybrook, August 1888 ! G. Barrett-Hamilton. Sub-var. *nigrescens*. Kingstown, June 1886 ! W. F. de Vismes Kane. Howth, Apl. 1887 ! R. F. Scharff. Cabragh Old Road, Dublin, Apl. 1886 ! J. R. Redding.

Wicklow—Enniskerry, Aug. 1904 ! P. H. Grierson.

Carlow—Sub-var. *nigrescens*, gardens, Fenagh House, Bagenalstown, Sept. 1904 ! Denis R. Pack-Beresford.

Westmeath—Sub-var. *nigrescens*, Knockdrin Demesne, Apl. 1892 ! R. F. Scharff.

Roscommon—Var. *marginella* and sub-var. *nigrescens*, Mote Park, Roscommon, Sept. 1904 ! Lord Crofton.

Leitrim—Sub-var. *nigrescens*, Swiss Valley, Glencar, July 1904 ! A. W. Stelfox.

Mayo W.—Sub-var. *nigrescens*, Annagh, and Dugort, Sept. 1886 ! J. G. Milne.

Galway W.—Aran Isles, Nov. 1890, R. F. Scharff.

Clare—Sub-var. *nigrescens*, Doonass, Aug. 1904 ! R. A. Phillips.

Limerick—Sub-var. *nigrescens*, Castleconnell, Sept. 1904 ! R. A. Phillips.

Tipperary N.—Shores of Lough Derg, etc., Sept. 1904 ! G. J. Fogerty.

Waterford—Var. *marginella* and sub-var. *nigrescens*, Raywell near Clonmel, April 1888, A. H. Delap.

Cork N.—Sub-var. *nigrescens*, Macroom, July 1904 ! P. H. Grierson ; and Convamore, Ballyhooley, Sept. 1904 ! J. N. Milne.

CONTINENTAL DISTRIBUTION.

Belgium—Sub-var. *marginata*, fields about Vielsalm, June 1867 (Colbeau, Bull. Mal. Soc. Belg., 1867).

France—Var. *marginella*, in the Oise, Maine-et-Loire, and the Vosges, also about Vannes in Morbihan, and Chirac in Lozère. Sub-var. *grisco-marginata*, in the wood of Mont-Saxonnet, Savoy, at an altitude of 3,300 feet.

Germany—Var. *marginella*, Spreewaldes, Brandenburg; Neuburg, Bavaria; and in Alsace.

Austro-Hungary—Var. *marginella*, North Bohemia (Slavik, Moll. Bohm., 1869).

Portugal—Sub-var. *nigrescens*, recorded by Morelet for the neighbourhood of Monchique, Tras-os-Montes.

Norway—Sub-var. *marginata*, Bergen, Laurvig, and Hardanger.

Denmark—Var. *marginata*, rare in gardens, Frederiksdal (Westerlund, 1897).

Russia—Sub-var. *swammerdamii* is recorded by Kaleniczenko as found about Sumy in Kharkov, but the record is said by Simroth to be erroneous.

Var. **maculata** Dum. & Mort., Cat. Moll. Savoie, 1857, p. 5.

Arion (*Limax*) *rufus* var. *maculatus* Dum. & Mort., op. cit.

ANIMAL with shield maculated with black.

France—Savoy (Dum. & Mort., op. cit.).

Monst. **sinistrorsum** Taylor.

ANIMAL with respiratory and other orifices on the left side of the body.

France—A single specimen of the var. *rufa* found in the wood at Mérard, department of the Oise (Baudon, Journ. de Conch., 1884, p. 196).

Geographical Distribution.—*Arion ater*, as probably one of the latest evolved species of the genus, has not yet obtained the wide dispersal that characterizes some of the simpler forms by which it was preceded.

On the continent, the aggregate form is well distributed throughout Central Europe, but apparently blending or intergrading near the outskirts of its range with *Arion subfuscus*, with which species it has been frequently confused by various writers.

Generally speaking, its distribution has been stated by the late Prof. Von Martens to range with that of the oak, about the isotherm of 42° Fahrenheit, but it is probable that this statement now needs revision, the range of this species apparently extending beyond what was previously known, while it has also been recorded as ascending the Pyrennean Mountains to a height of more than 6,000 feet.

In Norway, the red variety only reaches as far as the fiftieth parallel, but the black variety has been noted to extend to 68° north lat., while the var. *alba* is recorded from Trömsdalen, 69° 50′, its occurrence supporting Gredler's view that albinism is often an indication that the species has reached the limit of its geographic or vertical range.

It is known to occur in Germany, Belgium, Holland, France, Austro-Hungary, Switzerland, Denmark, Norway, Sweden, North Italy, Spain, Portugal, and the British Isles.

It has also been recorded for Russia, from the Ukraine, Finland, the Baltic provinces, and elsewhere, by Kaleniczenko, Nadjeschin, Kawall, and other writers, but, according to Simroth, in every case erroneously.

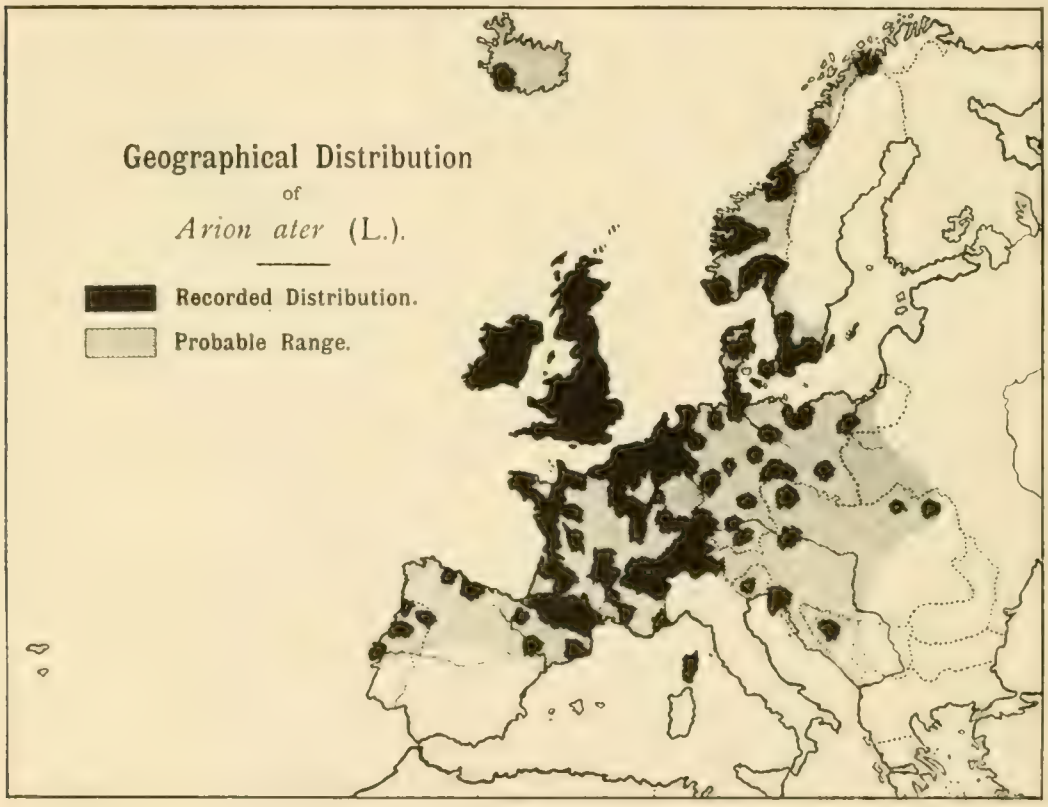


Fig. 206.

BRITISH ISLES.

In the British Isles this species is universally distributed, being found in all the one hundred and forty-nine comital and vice-comital districts into which the country has been divided, and has even been collected by Mr. W. E. Clarke on the Flannan Isles, the most westerly of the Outer Hebridean islets. This comprehensive survey of specimens has emphasized the dull, dark forms as the characteristic colouring in these islands; the brighter coloured varieties being more plentiful in the southern counties, and during warm dry summers, while the greater prevalence of the fasciate or juvenile colouring in Ireland shows the more primitive character of the fauna and its greater remoteness from the theatre of the most evolutionary activity.

The hypsometrical distribution is interesting, and shows a marked degree of correlation between the wholly jet-black variety *aterrima* and a lofty abode, as this variety is exclusively found, or is the most prevalent form, on the summit of Coniston Old Man, Sca Fell, and other elevated localities in England, while in Scotland it has been collected on Ben Voirlich at 3,224 feet, on Ben Nevis at 2,800 feet, and close to the very summit of Ben Lomond. In Ireland, the same form has been met with in the Mourne Mountains, at an altitude of 2,796 feet on Slieve Donard, and at 2,500 feet on Slieve Bingian. It has also been found on certain elevated stations in Donegal and Kerry. All the records tend to show the sensitiveness of the dermal pigmentation and its responsiveness to external influences.

GERMANY.

Arion ater has been recorded from Alsace, Baden, Bavaria, Brandenburg, Cassel, East Prussia, Franconia, Hanover, Holstein, Lauenberg, Mecklenburg, Nassau, Oldenburg, Osnabruck, Pomerania, Prussia, Reuss, Rhenish Prussia, Saxony, Schleswig, Silesia, Waldeck-Pyrmont, Westphalia, and Wurtemburg.

NETHERLANDS.

Belgium—Reported in many varieties from the provinces of Antwerp, Brabant, Hainault, Liége, Luxembourg, Namur, and West Flanders.

Holland—Cited in both its chief forms for Holland by Maitland.

FRANCE.

Arion ater is probably dispersed throughout France, and has been recorded for Corsica and the departments Ain, Aisne, Alpes Maritimes, Ariége, Aube, Aude, Basses Pyrénées, Cantal, Calvados, Charente Inférieure, Côte d'Or, Finistère, Gard, Gers, Gironde, Haute Garonne, Haute Loire, Haute Marne, Hautes Pyrénées, Haute Savoie, Ille-et-Vilaine, Isére, Loire Inférieure, Lot-et-Garonne, Lozère, Maine-et-Loire, Manche, Morbihan, Moselle, Nord, Oise, Pas-de-Calais, Puy-de-Dôme, Pyrénées-Orientales, Rhone, Savoie, Seine, Seine Inférieure, Seine-et Marne, Seine-et-Oise, Somme, Vendée, and Vienne.

ITALY.

The var. *rufa*, though recorded from Piedmont, Lombardy, Emilia, Tuscany, and Campania, is, according to Pollonera, not found naturally in Italy, and in Lombardy only by acclimatization, the remaining records being based on errors of identification.

AUSTRO-HUNGARY.

Recorded for Galicia at Lemburg by Jachno and on the Tatra by Nowicki; from Görz by Erjavec; from various localities in Austria by Fitzinger; Slavik and others report it as occurring, though not plentifully, throughout North Bohemia; while von Möllendorff records it from Maglaj, in the Bosnathal, Bosnia.

SPAIN AND PORTUGAL.

Spain—*Arion ater* has been recorded from Aragon, Asturias, Catalonia, Castile, Galicia, Huesca, and Navarre, all in the north of Spain.

Portugal—Reported by Simroth from Oporto, Caldas do Gerez in Minho, and Coimbra in Beira; and from Cintra, and Serra da Arrabida in Estramadura by Nobre. As *A. sulcatus* it is recorded by Morelet from the northern provinces, and as being especially common about Oporto.

SCANDINAVIA.

Norway—Common about Christiania, Christiansand, Bergen, and Trondhjem, extending to West Finmark, to Gröno in Nordland, and to Tromsdalen at 69° 50′ in Tromsö.

Sweden—Restricted to the southern extremity, but extending as far north as Westmanland, 60° north lat.; common at Ronneby, in Blekinge; somewhat rare at Ifö, in Scania, and present on the isles of Gotland and Oeland.

Denmark—Common in Denmark (Westerlund, Syn. Moll. Scand., 1897, p. 39).

Recorded by Von Martens for **South Iceland**, and by Collinge for the **Faroes**.

SWITZERLAND.

Recorded or known to exist in the cantons of Berne, Grisons, Lucerne, Neuchâtel, St. Gall, Solothurn, Schwytz, Ticino, Unterwalden, Uri, Vaud, and Zurich.

RUSSIA.

A. ater has been recorded from Finland by Heynemann; Courland by Kawall and Braun; Livland by Kawall; Esthland by Eichwald; Moscow by Nadjeschin; and as tolerably common in the woods of Tchernigov, Kharkov, and Poltava, by Kaleniczenko, who also gives precise localities for many of the varieties figured or described by Férussac, but Dr. Simroth, after an exhaustive investigation, totally denies the existence of *A. ater* in Russia, but it is very probable that it does really exist in the most western of the Baltic provinces.

Siberia—Gerstfeldt erroneously records *A. ater* from Wilni, Irkutsch.

NORTH AFRICA, ASIA MINOR, Etc.

Algeria—Recorded as *Arion rufus* by Aucapitaine, but probably more correctly referable to *Arion lusitanicus* or other form of the *subfuscus* group.

ATLANTIC ISLES.

Reported from the Azores, Madeira, and Canary Isles, but Dr. Simroth says the species occurring there are *A. lusitanicus* and its allies.

NEARCTIC REGION.

United States—Grateloup, in 1855, records *Arion empiricorum* as found in the Western States, but this is not confirmed by more recent authors.

AUSTRALASIAN REGION.

New Zealand—Recorded for Dunedin by Hutton, and by Musson as found crawling about after rain over the roads around Auckland.

Fig. 207.—Typical habitat of *Arion ater* var. *aterrima*, at an altitude of 2,500 feet on the higher south-western slopes of Slieve Bingian, Mourne Mountains, Co. Down, Ireland (photo. by Mr. R. Welch).

Distribution of *Arion ater* (L.)

In the Counties and Vice-Counties of the British Isles.

ENGLAND AND WALES.

Channel Isles

PENINSULA
1 Cornwall W.
2 Cornwall E.
3 Devon S.
4 Devon N.
5 Somerset S.
6 Somerset N.

CHANNEL
7 Wilts N.
8 Wilts S.
9 Dorset
10 Isle of Wight
11 Hants S.
12 Hants N.
13 Sussex W.
14 Sussex E.

THAMES
15 Kent E.
16 Kent W.
17 Surrey
18 Essex S.
19 Essex N.
20 Herts.
21 Middlesex
22 Berks.
23 Oxford
24 Bucks.

ANGLIA
25 Suffolk E.
26 Suffolk W.
27 Norfolk E.
28 Norfolk W.
29 Cambridge
30 Bedford
31 Hunts.
32 Northampton

SEVERN
33 Gloucester E.
34 Gloucester W.
35 Monmouth
36 Hereford
37 Worcester
38 Warwick
39 Stafford
40 Salop

SOUTH WALES
41 Glamorgan
42 Brecon
43 Radnor
44 Carmarthen
45 Pembroke
46 Cardigan

NORTH WALES
47 Montgomery
48 Merioneth
49 Carnarvon
50 Denbigh
51 Flint
52 Anglesey

TRENT
53 Lincoln S.
54 Lincoln N.
55 Leic. & Rutld.
56 Notts.
57 Derby

MERSEY
58 Cheshire
59 Lancashire S.
60 Lan'shire Mid

HUMBER
61 S.E. York
62 N.E. York
63 S.W. York
64 Mid W. York
65 N.W. York

TYNE
66 Durham
67 Northumb. S.
68 Cheviotland

LAKES
69 Westmorland and L. Lancs.
70 Cumberland
71 Isle of Man

SCOTLAND.

W. LOWLANDS
72 Dumfries
73 Kirkcudbright
74 Wigtown
75 Ayr
76 Renfrew
77 Lanark

E. LOWLANDS
78 Peebles
79 Selkirk
80 Roxburgh
81 Berwick
82 Haddington
83 Edinburgh
84 Linlithgow

E. HIGHLANDS
85 Fife & Kinross
86 Stirling
87 Pth. S. & Clkn.
88 Mid Perth
89 Perth N.
90 Forfar
91 Kincardine
92 Aberdeen S.

E. HIGHLANDS
93 Aberdeen N.
94 Banff
95 Elgin
96 Easterness

W. HIGHLANDS
97 Westerness
98 Main Argyle
99 Dumbarton
100 Clyde Isles
101 Cantire
102 Ebudes S.
103 Ebudes Mid
104 Ebudes N.

N. HIGHLANDS
105 Ross W.
106 Ross E.
107 Sutherland E.
108 Sutherland W
109 Caithness

NORTH ISLES
110 Hebrides
111 Orkneys
112 Shetlands

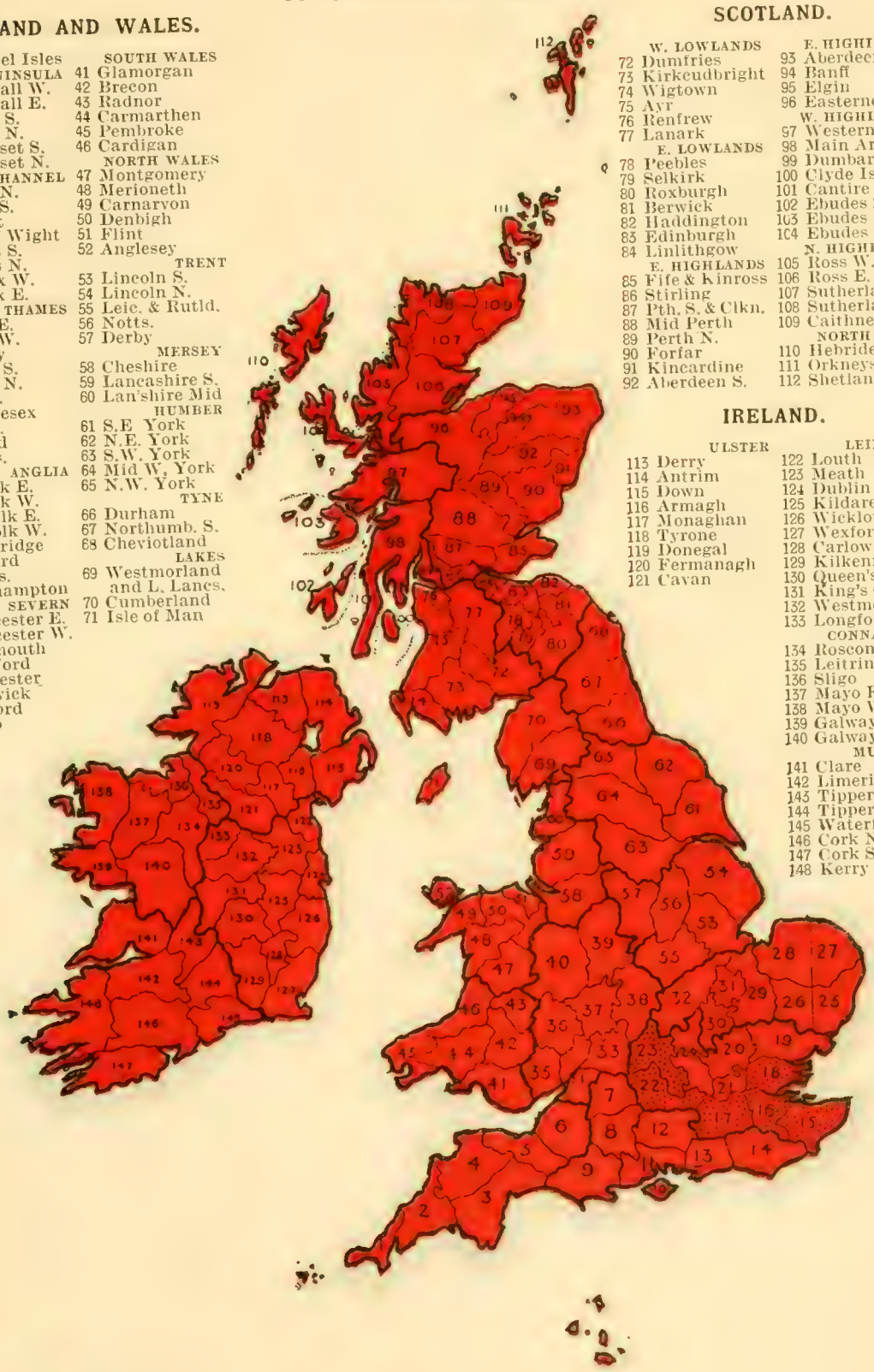
IRELAND.

ULSTER
113 Derry
114 Antrim
115 Down
116 Armagh
117 Monaghan
118 Tyrone
119 Donegal
120 Fermanagh
121 Cavan

LEINSTER
122 Louth
123 Meath
124 Dublin
125 Kildare
126 Wicklow
127 Wexford
128 Carlow
129 Kilkenny
130 Queen's Co.
131 King's Co.
132 Westmeath
133 Longford

CONNAUGHT
134 Roscommon
135 Leitrim
136 Sligo
137 Mayo E.
138 Mayo W.
139 Galway W.
140 Galway E.

MUNSTER
141 Clare
142 Limerick
143 Tipperary N.
144 Tipperary S.
145 Waterford
146 Cork N.
147 Cork S.
148 Kerry

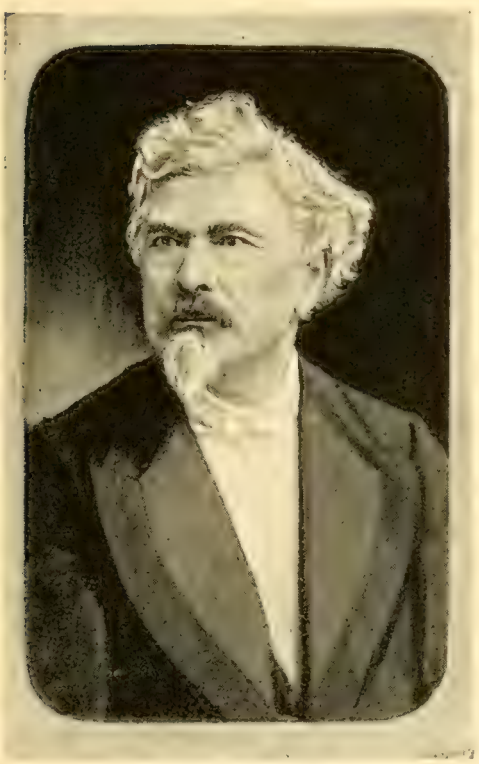


Distribution verified by the Authors.

Fossil Distribution.

Arion subfuscus (Draparnaud).

1805 *Limax* **subfuscus** Draparnaud, Hist. Moll., p. 125, pl. 9, f. 8.
1822 — *fasciatus*, vars. ϵ, ζ, and η Nilsson, Hist. Moll. Sveciae, p. 4.
1819 **Arion** *fuscatus* Férussac, Hist. Moll., p. 65, pl. 2, f. 7.
1836 — *succineus* Bouillet, Moll. Auvergne, p. 14.
1838 — *subflavus* Johnston, List Pulm. Moll. Berwick and North Durham.
1842 — *fuscus* Binney, Boston Journ. Nat. Hist., iv., p. 170.
1851 — *krynickii* Kaleniczenko, Bull. Moscow, p. 114, pl. 4, f. 1.
1852 — *cinctus* Dum. et Mort., Malac. Savoie, p. 7.
1856 — *olivaceus* Schmidt, Verh. Nat. Ver. Preuss. Rheinl., p. 58.
1861 — *brunneus* Lehmann, Mal. Bl., p. 166.
1866 — *mabillianus* Bourguignat, Moll. litig. etc., p. 173, pl. 29, f. 1-4.
1868 — *rubiginosus* Baudon in Drouet, Moll. Côte d'Or, p. 26.
1870 — *gaudefroyi* Mabille, Hist. Moll. Bass. Paris, p. 12.
1871 — *citrinus* Westerlund, Exposé Crit., p. 14.
1884 — *pollonerœ* Pini, Nov. Mal., p. 42.
1885 — *stabilei* Pollonera, Elencho Moll. Terr. Piem., p. 28.
1887 — *bavayi* Pollonera, Spec. nuove ecc., p. 12, f. 15.
1890 — *flavus* Pollonera, Arionidæ Rég. Paléarct., p. 15.
1893 — *flagellus* Collinge, Ann. and Mag. Nat. Hist., p. 252, pl. 9.
1897 — *rufus* Westerlund, Syn. Moll. Extram. Scand., p. 40.
1870 *Prolepis fuscus* Malm, Skand. Land-Sniglar, p. 43, pl. 2, f. 3.



Dr Aug. Baudon

HISTORY.—*Arion subfuscus* (*subfuscus*, brownish), was first clearly described and figured by Draparnaud, in 1805, although there seems reasons to believe that the *Limax fuscus* and *L. cinctus* of Müller belong to the same species.

In this country, *A. subfuscus* was long confounded with *A. ater*, or regarded as a variety or immature form of that species, Herr D. F. Heynemann being the first to publish it as British, in 1885, although prior to that date Mr. Roebuck, with the assistance of the late Mr. Ashford, had identified it as a native of this country.

Moquin-Tandon, also, did not clearly distinguish this species from his *Arion rufus*, as may be seen on examining his figure of the reproductive organs ascribed to that species (Hist. Moll. France, pl. 1, f. 12). The shape and character of the free oviduct and the point of fixation of the retractor are undeniably those of *Arion subfuscus*, while the absence of the large vestibular protuberance so characteristic of *A. ater*, is convincing testimony that the figure is based upon a dissection of an individual of the present species.

With this species the name of Dr. Aug. Baudon, of Mouy, France, is associated, in token of appreciation of the merits of his work, "Mémoire sur les Limaciens du Département de l'Oise," and of the numerous other valuable malacological treatises of which he is the author.

Diagnosis.—*Arion subfuscus* may be distinguished from *A. ater*, the species with which it is most liable to be confounded, by its smaller size, flatter and shorter rugosities, less uniform colouring, whitish sides, and the presence of dark lateral banding on the body and shield; the foot-fringe is also usually whitish or yellowish grey, with dark though less regular lineolation than in *A. ater*, and the animal cannot assume the hemispherical shape when at rest which is so marked a feature of that species.

In the juvenile stage the affinity with *A. ater* is even more striking, but in the latter species the rugæ are invariably more elongate and separated by bluish interstices; moreover, in *A. subfuscus* the body is always comparatively longer when at rest, and there is always more or less orange slime on the shield, which is absent in the larger species; the body also is always darker than the shield, whereas in *A. ater* the coloration is usually more perceptibly uniform.

Internally, this species is separable from its congener by the different point of fixation of the oviducal retractor, and by the constant and marked inflation of the free oviduct, an inflation quite unlike the gradual basal enlargement in *Arion hortensis*, or the bulbous expansion of the vestibule in *Arion ater*, while there is usually a large flesh-coloured mass or ruffle at the base of the albumen gland.

Description.—Animal of medium size, reaching eighty millimetres in length when adult and fully extended, of a dull uniform dusky-brown above, ochreous subdorsally, becoming whitish towards the sole, with a more or less distinct blackish or black longitudinal band at each side, extending over body and shield; body tubercles moderately pronounced, finer, slenderer, and flatter than in *Arion ater*, and nowhere fused into longitudinal ridges, with about twenty-five longitudinal series on each side; shield attenuated in front, broadly rounded and almost truncate behind, shagreened, with lyre-shaped dusky, longitudinal marking, arching the respiratory orifice and becoming less distinct behind; respiratory orifice round, slightly angulated below to the anal cleft, which is directed forwards; head usually somewhat darker than the body; neck pale, with four parallel longitudinal furrows, two continuing to the forehead, while the outer grooves reach the dusky ommatophores; lower tentacles capped with brown; sole indistinctly tripartite, pale yellowish-white, tinged with brown towards the tail, and minutely beset with milk-white points, mid-area slightly more transparent; foot-fringe pale yellowish-grey, lineolated similarly to *Arion ater*, but less regularly and more faintly, and scarcely continued over the side-areas of the sole.

Dermal-Mucus occasionally almost colourless but generally of a pale yellow, or when scalded, of an orange colour, and usually most dense on the anterior part of the mantle and near the caudal gland; that emitted by the tail-gland is ropey and almost colourless; Locomotory-Mucus colourless, but stained by admixture with the dermal secretion. The yellow colour of the body appears to be often due to the slime, as when this is removed after scalding, the skin is almost invariably dull greyish or greyish-brown.

The Shell may be at times wholly absent, or quite vestigial, and represented only by amorphous granular white matter, which solidifies in drying.

Internally, the walls of the body-cavity are grey, densely beset with milk-white limey particles. The supra-pedal gland is imbedded in the tissues, and visibly extends for about three-fourths of the total length of the body. The buccal ganglia are oblong with a short commissure; the supra-œsophageal ganglia are opaque-white anteriorly; the sub-œsophageal group are intimately fused together. The undivided aorta is four or five mill. long, of an opaque-white colour, as are all the arterial branches, rendering them very conspicuous over the stomach, liver, and other dark internal organs. The otoliths are very numerous, of a more broadly oval shape than in *A. hortensis*, and often with a central speck.

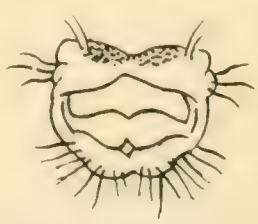


Fig. 209.—Nerve centres of *Arion subfuscus* (much enlarged). (Christchurch, Hants S., Mr. C. Ashford).

Fig. 210.—Cephalic retractors of *Arion subfuscus* × 2. (Christchurch, Hants. S., Mr. C. Ashford).

The CEPHALIC RETRACTORS of this species are arranged as in *Arion ater*; the TENTACULAR retractors are broad, and divide early for the ommatophore and lower tentacle; they are set obliquely, and arise from seven to nine mill. apart, a little in advance of the hind margin of the shield on the posterior right and posterior left side respectively; the comparatively slender PHARYNGEAL retractor arises somewhat to the right of the median-line, a trifle behind the mantle margin; it divides early into two slender branches, which become fixed to opposite sides of the buccal bulb.

The REPRODUCTIVE ORGANS display a sepia-brown and lobular OVOTESTIS, and a creamy-white HERMAPHRODITE DUCT, terminating in a distinct VESICULA SEMINALIS, which is grey, sometimes speckled with deep-brown; the ALBUMEN GLAND is semi-transparent and gelatinous, indistinctly lobular, and of pale yellowish-grey colour; the OVIDUCT is bluish-grey, broadly sacculate, bound together in convolutions, and showing a flesh-coloured ruffle at the base of the albumen gland, which has the aspect of semi-gelatinous tubing, recalling the vestibular glands of *Milax sowerbii*; the SPERM DUCT is creamy-white above, much thickened and ochraceous below; the long, slender, and semi-transparent VAS DEFERENS passes into the opaque-white and tapering EPIPHALLUS, whose base is encircled by a conspicuous raised ring, and within which is formed the very long and serrate SPERMATOPHORE; the large and globose SPERMATHECA is at maturity usually whitish, stiff, and hard, connected to the oviduct by tissue and small

Fig. 211.

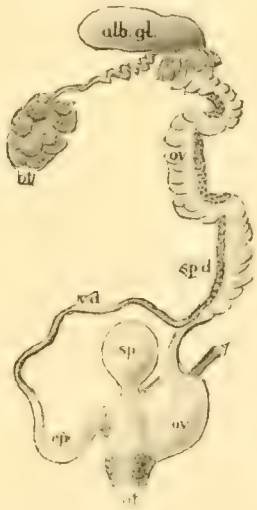


Fig. 212.

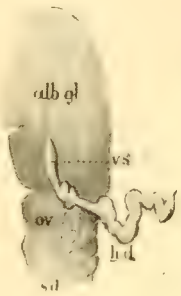


Fig. 213.

Fig. 214.

Fig. 211.—Alimentary canal of *A. subfuscus*, with buccal bulb and nerve-ring, × 2 (Christchurch, Hants. S., Mr. C. Ashford).

Fig. 212.—Sexual organs of *A. subfuscus*, × 2.

Fig. 213.—Portion of the sexual system of *A. subfuscus*, showing the vesicula seminalis, × 4.

Fig. 214.—Spermatophore of *A. subfuscus*, × 6, with magnified portions showing details of structure (after original drawing by Dr. Simroth).

alb.gl. albumen gland; *at.* atrium; *ep.* epiphallus; *h.d.* hermaphrodite duct; *ot.* ovotestis; *ov.* oviduct; *r.* retractor; *sp.* spermatheca; *s.d.* and *sp.d.* sperm duct; *v.s.* vesicula seminalis.

muscular strands especially at apex of vesicle, the stalk is rather short and greatly swollen basally, contracting where it joins the vesicle; the FREE OVIDUCT is at first comparatively simple and slender, but enlarges abruptly and characteristically in the latter part of its course, and shows internally a varied series of longitudinal thickenings; the GENITAL RETRACTOR arises near the origin of the left tentacular retractor, and becomes furcate, one branch being attached to the stem of the spermatheca, and the other to the upper part of the swollen free-oviduct. In this species there does not seem to be any striking constriction of the ATRIUM, which is, however, invested by a well-defined yellowish glandular pad.

The ALIMENTARY CANAL is triodromous, exhibiting the effects of the torsion of the viscera, and greatly resembling the intestinal canal of the juvenile *Arion ater*; the ŒSOPHAGUS is usually about three mill. broad, and of a whitish colour; the

SALIVARY GLANDS are yellowish, and frequently form a collar round the œsophagus, uniting above and embracing the anterior part of the crop, like turned up moustaches; the SALIVARY DUCTS white; CROP dusky-buff in colour, and distinctly wrinkled longitudinally; DIGESTIVE GLAND dark brown.

The MANDIBLE or jaw is about 1½ mill. broad and half mill. wide, crescentic in shape, with rather acutely-rounded ends, arcuate from front to back, but somewhat flexible, of a deep amber-brown colour along the lower or cutting-edge, gradually blending with the paler tint of the upper moity; the anterior surface bears ten to sixteen broad, rounded ribs, which show well-marked vertical striæ, and strongly crenulate the upper margin, and sometimes denticulate the lower margin also, especially near the centre, simulating a rostrum or beak; the interspaces between the projecting ribs is of perceptibly more delicate texture and shows the horizontal wavy striation most perceptibly.

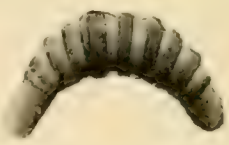


FIG. 214.—Mandible or jaw of *Arion subfuscus*, × 15. (Christchurch, Mr. Ashford).

The LINGUAL MEMBRANE is oblong in shape, about 4½ mill. long and two mill. wide, and composed of about 140 slightly curved transverse rows of closely-set teeth, which appreciably diminish in size at the outer margin; each row is composed of a tricuspid median tooth, with about fifteen obscurely tricuspidate laterals, the endocone gradually degenerating, and the ectocone acquiring correspondingly greater strength and importance; the marginal teeth are about thirty in number at each side, and are essentially and strongly bicuspidate, constituted by the well-developed mesocone and ectocone.

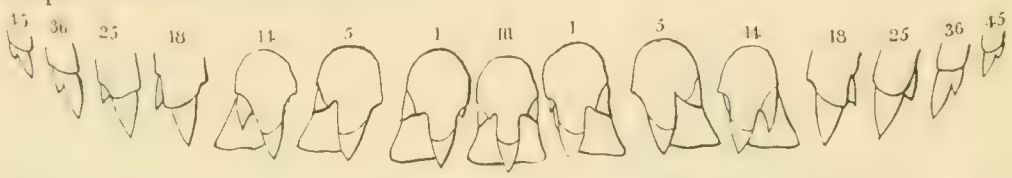


FIG. 215.—Representative denticles from a transverse row of the lingual teeth of *A. subfuscus*, × 180. The animal collected by Mr. C. Ashford, and the palate prepared by Mr. J. W. Neville.

The formula of a Christchurch specimen collected by Mr. C. Ashford is

$$\frac{30}{2}+\frac{15}{2\text{-}3}+\frac{1}{3}+\frac{15}{2\text{-}3}+\frac{30}{2}\times 140 = 12{,}740.$$

Reproduction and Development.—The congress of this species is probably marked by the same blandishments and circular procession as in *Arion ater*, yet although it breeds freely in confinement, no definite observations are on record. The eggs, which are chiefly deposited in the late summer and autumn months, are oval in shape, averaging 3 mill. long by 2½ mill. in diameter, of a dusky white, but sometimes amber or dull primrose colour, or even pale green, translucent, and much clearer than those of *A. ater*, slightly granulate on the surface, and connected together by a colourless or yellowish mucus; they are laid upon or beneath the ground in clusters varying in number from about twenty to sixty or more. The young apparently pass through the winter in the juvenile stage, as all the specimens observed by Dr. Scharff, even as late as May, were immature. The young, according to Clessin, differ from those of *A. ater*, which are almost invariably of an uniform light yellow or greenish colour, as they are usually darkly coloured, and only pale to some extent with age.

Food and Habits.—*Arion subfuscus* is naturally very partial to fungi, and has been observed to frequent and feed upon *Russula fuscata*, as well as the poisonous *Agaricus muscarius*. In summer it has been observed feeding upon the leaves of *Leontodon autumnale*, but in autumn they display a great partiality for fungi.

In captivity, according to Mr. Wallis Kew, they eat bread and lettuce freely, the decaying leaves of the Deadly Nightshade (*Solanum dulcamara*) are also eaten, as well as dead slugs of their own or other species. The fungus *Phallus impudicus* was also offered and greedily devoured, but the animals feeding upon it died soon afterwards.

Mr. Gain found that of 130 different kinds of food tendered to them while in confinement only one, the Violet (*Viola odorata*) was eaten with avidity, although forty-six other kinds were eaten freely, forty less readily, and only forty-three were totally rejected.

This species frequents both deciduous and pine forests, and ascends the mountains to the limit of trees, but it also lives in gardens at the foot of walls and rocks, under hedges bordering meadows or roads and other places. It is fairly plentiful on the London clay, in gardens, etc., in North London, but is often especially abundant, fine and richly coloured on or near refuse-heaps. Like its congeners, it is somewhat slow, timid, and clumsy, though more active than *A. ater*, but when young or partly grown is a great adept at spinning mucus threads, and has been known to spin a thread thirty-seven inches in length. It is one of the few species of slug which has been actually observed and recorded as able to reascend its thread. This is effected by curving the anterior part of the body upwards until the fore-part of the foot comes into contact with the hinder portion, up which the creature then crawls until the thread is reached, the animal then applies its foot to the thread, and at once proceeds to ascend by its aid, the foot remaining nearly flat or only slightly folded in front. During the operation the head is moved from side to side and mucus gradually accumulates in an irregular mass above the tail, evidently composed in part of the slack of the thread, as it could be to some extent unwound or disentangled from the mass.

Parasites and Enemies.—The general enemies of the slugs also prey upon this species, but, according to Mr. L. E. Adams, poultry which refuse *Arion ater* will eat this species without hesitation. Numerous intestinal worms have been at times detected within this slug, but they have never been identified.

Variation.—This species does not display that wealth of colour-variation shown by *Arion ater*, the variations being chiefly due to the greater or lesser intensity of the rufous tint, and the more or less complete overspreading of the body by the darker hue of the dorsal surface; this

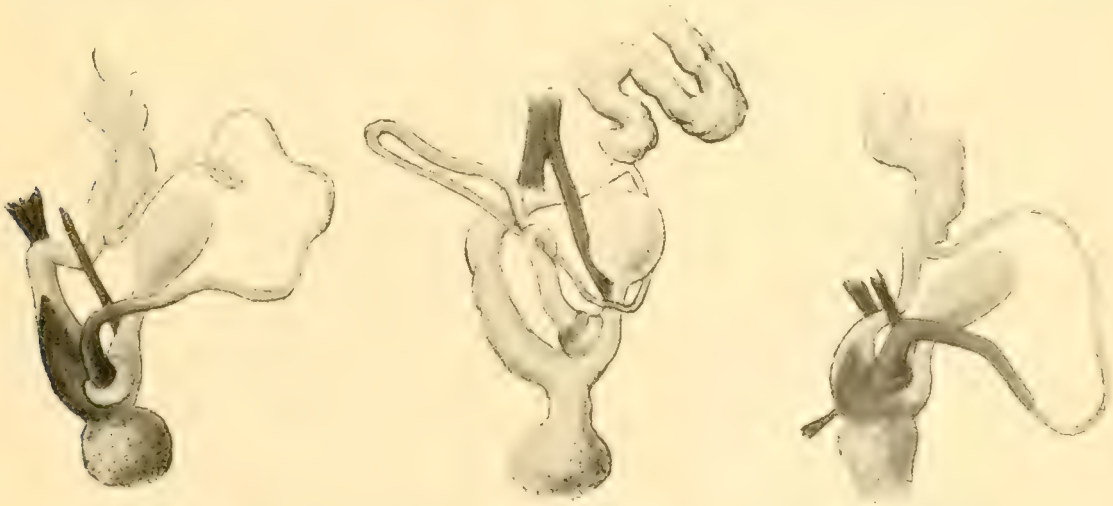


Fig. 216. Fig. 217. Fig. 218.

Proximal ends of the Reproductive Organs of *Arion lusitanicus* and *A. nobrei*.
Fig. 216.—*Arion lusitanicus* (after Pollonera). Fig. 217.—*Arion lusitanicus* (after Simroth).
Fig. 218.—*Arion nobrei* (after Pollonera).

distribution of colouring is, however, liable to be reversed, a variety found on the Serra d'Estrella having the dorsum clear brown, while the sides of

the body are nearly black; this greater uniformity is naturally to be expected, as *A. subfuscus* is a more ancient species and not a dominant form.

The junction of its distribution with the limits of the more restricted area inhabited by *A. ater*, is complicated in those districts by the external approximation in aspect of the two species, a resemblance which has been the cause of great confusion, as many authors have, at various times, recorded the present species under one or other of the different names of its larger congener.

On the Finnish shores of the Gulf of Finland, the var. *fennica* assimilates in a very remarkable way to *Arion ater*, under which name it has frequently been recorded; while the *Arion lusitanicus*, *A. nobrei*, and *A. dasilvae*, which have been described from the Spanish peninsula, are undoubtedly intermediate forms linking *subfuscus* with *ater*, resembling *subfuscus* in their internal structure but often approximating externally more closely to *ater* especially in size and colouring.

The *Arion flagellus* of Collinge, which is here regarded as a simple variety of *A. subfuscus*, is said to possess as its characteristic feature a distinct flagellum upon the free oviduct, a most improbable situation for such an organ; but, as the illustrative figures of the author are somewhat carelessly or inaccurately executed, it is quite possible that the proposed species has been presented under a misapprehension of the precise structure of the animal.

The yellow colouring of the body, though in general due to the mucous investment, is not invariably so, as in some cases the colouring is really due to the breaking through the skin of the superficially placed colour glands.

The yellow dermal mucus, though so characteristic a feature, is also not an invariable trait of this species, as the darker and also the more pallid varieties more frequently emit an almost colourless slime.

Arion subfuscus, like *Limax arborum* and *Arion ater*, offers, according to Simroth, the same striking evidence of the darkening influence of altitude, as the individuals inhabiting the lofty mountain ranges are invariably darker than those living on the plains below.

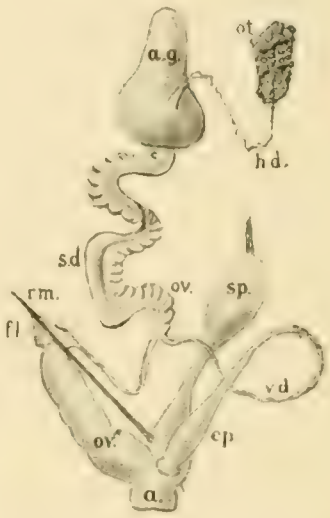


FIG. 219.—Reproductive Organs of *Arion flagellus* Collinge (after Collinge). The ovispermatoduct is incorrectly represented, and some of the organs wrongly identified in Collinge's original figure. The figure is, however, here given as in the original, but the nomenclature of the organs is corrected.

a.g. albumen gland; *a.* atrium; *ep.* epiphallus; *fl.* flagellum; *h.d.* hermaphrodite duct; *ot.* ovotestis; *ov.* oviduct; *ov'.* free oviduct; *r.m.* retractor muscle; *s.d.* sperm duct or prostate; *sp.* spermatheca; *v.d.* vas deferens.

On the contrary, Dr. Scharff expresses the opinion that in Ireland the more or less unicolorous pale yellow variety is more especially characteristic of the higher parts of the country while the darker typical form inhabits the plains.

VARIATIONS IN COLOUR AND MARKINGS OF ANIMAL.

Var. **rufo-fusca** Draparnaud, Hist. Moll., 1805, p. 125.

Arion cinctus var. *rufescens* Dum. & Mort., Moll. Savoie, 1857, p. 7.
Arion rubiginosus Baudon in Drouet, Moll. Côte d'Or, 1868, p. 26.
Arion gaudefroyi Mabille, Hist. Moll. Paris, 1870, p. 12.

ANIMAL of a rufous tint, most pronounced on the mantle and the sides of the body, dorsum darker, the lateral band black or blackish.

This form is the one selected by Draparnaud as the type of the species; but the rufous colouring is in many cases entirely due to the mucous investment.

Var. **bicolor** Moquin-Tandon, Hist. Moll., 1855, p. 11.

Arion rufus var. *bicolor* Moquin-Tandon, l.c.
Arion empiricorum var. ι Férussac, Hist. Moll., 1819, p. 62, pl. 1, ff. 6-7.
Arion subfuscus var. *lateritius* Collinge, Conchologist, 1892, p. 63.

Animal of a red or reddish colour, with darker dorsum, without darker lateral banding.

The var. **bicolor** s.str., animal orange-red, with brown dorsum, foot-fringe orange with black lineolation.

The sub-var. **lateritia** is of a deep brick-red, which is not due to mucus, lateral bands absent, foot-fringe light grey, lineolated with pale brown or chocolate.

WALES.

Glamorgan—A sub-var. of a rich wine colour on banks of river Ely, St. Fagan's, near Cardiff, March 1885 ! F. W. Wotton.

SCOTLAND.

Fife and Kinross—Sub-v. *lateritia*, Mount Melville, St. Andrews (Collinge, l.c.).

IRELAND.

Dublin—A sub-variety found by Dr. Scharff in a small pine-wood, in Lord Howth's demesne, Howth, in Sept. 1900, had a pale reddish-brown shield, and reddish body rugæ, a colouring not, as is usual, entirely due to slime, but to the presence of superficial pigment cells.

CONTINENTAL DISTRIBUTION.

France—Environs of Paris (Férussac, op. cit., p. 63).

Var. **fuliginea** Morelet, Moll. Port., 1845, p. 30, pl. 2, f. 1.

Arion fuligineus Morelet, op. cit.
Arion (*Limax*) *cinctus* var *fuscescens* Dum. & Mort., Moll. Savoie, 1857, p. 7.
Arion brunneus Lehmann, Mal. Blatt., 1861, p. 166.
Arion limacopus Westerlund, Exp. Crit. Moll., 1871, p. 36.
Arion flagellus and var. *phillipsi* Collinge, Mag. Nat. Hist., 1893, p. 252, pl. 9.

Animal of a dark brown, sides paler, with or without darker lateral banding, fringe yellowish.

The var. **fuliginea** s.str., is of a rich brown, dorsum and shield very dark smoky-brown, foot-fringe yellow, reddish at the extremities.

The sub-var. **brunnea** is coffee-brown, the dorsum darker brown or blackish, the sides of body and shield paler red-brown, lateral banding indistinct, fringe yellowish with black lineolation; mucus colourless.

The sub-var. **limacopa** is dark fuscous above, paler on the sides; mucus yellow.

The sub-var. **flagella** is dark vandyke-brown along the back, light brown on the sides, upon which are the vandyke-brown lateral bands; the foot-fringe and vicinity are pale brownish-white, the fringe with sepia lineoles; sole pale yellow.

The sub-var. **phillipsi** differs in the back and mantle being deep mahogany-brown, the sides of body white with black dashes.

ENGLAND.

Somerset S.—Sub-var. *brunnea*, Bridgwater, Aug. 1884 ! W. Vinson.
Hants. N.—Sub-v. *brunnea*, Preston Candover, Nov. 1885 ! Rev. H. P. Fitzgerald.
Surrey—Sub-var. *brunnea*, Haslemere, E. W. Swanton (C. Pannell, Journ. of Conch., Jan. 1902).
Middlesex—Sub-var. *brunnea*, Churchyard Bottom Wood, Highgate, May 1889 ! H. Wallis Kew.
Warwick—A modified form of the sub-var. *flagella*, Sutton Coldfield, H. Overton (W. E. Collinge, Journ. of Mal., Dec. 1904, p. 98).
Salop—Sub-var. *brunnea*, Oswestry, June 1885 ! Baker Hudson.
Pembroke—Sub-var. *brunnea*, near Pembroke, June 1885 ! Mrs. Trayler.
Notts.—Sub-var. *brunnea*, garden, Tuxford, April 1885 ! W. A. Gain.
Derby—Sub-var. *brunnea*, Clifton, 1889 ! Lionel E. Adams.
Northumberland S.—Sub-var. *brunnea*, Stocksfield-on-Tyne, May 1885 ! H. E. Craven.
Cumberland—Sub-var. *brunnea*, Skiddaw Forest, Sept. 1890 ! Rev. J. Hawell.

SCOTLAND.

Perth Mid—Sub-var. *brunnea*, Dunkeld road on banks of river Tay, Sept. 1904 ! W. Evans.
Aberdeen S.—Sub-var. *brunnea*, garden, Rubislaw, Aberdeen, Oct. 1904 ! G. Sim.

IRELAND.

Armagh—Sub-var. *brunnea*, Armagh, June 1885 ! Rev. H. W. Lett.
Monaghan—Sub-var. *brunnea*, Drumreaske, Sept. 1904 ! W. F. de Vismes Kane.
Louth—Sub-var. *brunnea*, near Blackhall demesne, Sept. 1904 ! P. H. Grierson.

Kildare—Sub-var. *brunnea*, Naas, Oct. 1904 ! R. J. Pack-Beresford.
Sligo—Sub-var. *brunnea*, Rockwood, Lough Gill, Oct. 1886 ! W. F. de V. Kane.
Mayo W.—Sub-var. *brunnea*, Enniscoe demesne, Crossmolina, Sept. 1885 ! W. F. de Vismes Kane.
Galway W.—Sub-v. *brunnea*, Kylemore Castle Gardens, Sep. 1904 ! W. Comfort.
Cork S.—Sub-var. *flagella* and *phillipsi*, Schull, July 1893 (Collinge, l.c.).
Kerry—Sub-var. *brunnea*, Valentia Island, Sept. 1904 ! Miss M. J. Delap.

CONTINENTAL DISTRIBUTION.

Germany—Sub-var. *brunnea*, Höckendorff, Pomerania.

France—Sub-var. *fuscescens*, Savoy (Dum. & Mort., op. cit.).

Switzerland—Sub-var. *brunnea*, Wildhaus, in the canton St. Gall, at about 3,600 feet altitude. Also at an altitude of 6,000 feet near Maloja in the Grisons.

Austro-Hungary—Sub-var. *brunnea*, Carlsbad, Bohemia, April 1884 (Bœttger, Nachbl., 1885, p. 54).

Portugal—Var. *fuliginea*, Ponte do Lima, Douro (Morelet, op. cit.).

Norway—Sub-var. *brunnea*, common at Tromsoen, also at Andenaes on the Ando. A pale variety at Stanganaes at the mouth of the Tana river.

Sweden—Sub-var. *limacopa*, recorded for Ronneby in Blekinge, and Stehag in Scania (Westerlund, op. cit.).

Russia—Sub-var. *brunnea*, Konginkangas, Finland (Luther, Finland Gastrop., 1901, p. 57).

Var. **nigricans** Pollonera, Spec. nuove ecc., 1887, p. 14.

ANIMAL with shield and body entirely black, lateral fascia more or less inconspicuous.

CONTINENTAL DISTRIBUTION.

France—Found occasionally (Pollonera, op. cit.).

Italy—In the Alps (Pollonera, op. cit.).

Norway—Kistrand (Esmark & Hoyer, Mal. Bl., 1886, p. 103).

Var. **cinereo-fusca** Draparnaud, Hist. Moll., 1805, p. 125.

Arion cinctus var. *cinereus* Dum. et Mort., Moll. Savoie, 1857, p. 7.
Arion subfuscus var. *ardosiarum* Colbeau, Bull. Belg. Mal. Soc., 1867, p. 72.
Arion subfuscus var. *typus* Pollonera, Arionidæ, Rég. Paleárct., 1890, p. 11.
Arion subfuscus var. *griseus* Collinge, Conchologist, 1892, p. 63.

BODY ash-coloured or greyish, with or without blackish lateral band.

The var. **cinereo-fusca** s.str. is ash-coloured or greyish, with a blackish lateral band at each side.

The sub-var. **ardosiarum** is of a dull greyish-rufous, tinged with blackish, shield more rufous, a faint blackish lateral band at each side.

The sub-var. **grisea** is grey with paler sides, without lateral bands.

ENGLAND AND WALES.

Channel Isles—St. Sampson's, Guernsey, Sept. 1891 ! B. Tomlin.
Cornwall W.—Gardens, Truro, April 1886 ! J. H. James.
Devon S.—Teignmouth, Aug. 1888 ! L. St. G. Byne.
Devon N.—Belstone near Okehampton, Sept. 1904 ! Rev. W. Wright Mason.
Dorset—Montevideo, Chickerell near Weymouth, Sept. 1904 ! N. M. Richardson.
Sussex W.—Up Park, Aug. 1886 ! W. Jeffery.
Middlesex—Muswell Hill road, Highgate, July 1888 ! H. Wallis Kew.
Monmouth—Banks of river Wye, Monmouth, July 1891 ! W. Whitwell. Garden, Rose Cottage, Talywain, July 1904 ! J. Manners.
Worcester—Sub-var. *grisea*, W. E. Collinge, Jan. 1905.
Warwick—Sub-var. *grisea*, W. E. Collinge, Jan. 1905.
Brecon—Erwood, Oct. 1904 ! J. Williams Vaughan.
Carmarthen—Near Llanelly, Sept. 1904 ! H. Rowland Wakefield.
Pembroke—Pembroke, June 1885 ! Mrs. Trayler.
Carnarvon—Slopes of Snowdon, April 1887 ! J. Madison.
Lincoln N.—Ulceby-with-Fordington, Oct. 1889 ! J. Burtt Davy.
Lancashire S.—Sub-var. *grisea*, Knowsley, 1893 (W. E. Collinge, J. of Mal., 1893, p. 148).
York N.E.—Ingleby Greenhow, Sept. 1890 ! Rev. J. Hawell.
Westmorland and Lake Lancashire—Grasmere, June 1886 ! C. Oldham. Sub-var. *grisea*, Grange, 1897 (H. V. Fowler, J. of Mal., 1899, p. 38).

SCOTLAND.

Dumfries—Moffat, Jan. 1891 ! W. Evans.
Renfrew—Braidland, Aug. 1890 ! J. M. B. Taylor.
Roxburgh—Jedburgh, Sept. 1904 ! J. Roseburgh.
Berwick—Dryburgh, Aug. 1886 ! W. Denison Roebuck.
Edinburgh—Braidburn, Edinburgh, July 1888 ! W. E. Clarke.
Fife and Kinross—Loch Gelly, May 1895 ! W. Evans. Sub-var. *grisea*, Mount Melville, St. Andrews (W. E. Collinge, l.c.).
Perth Mid—Glen Ogle, Lochearnhead, June 1904 ! Rev. R. Godfrey. Dunkeld road, Perth, Sept. 1904 ! W. Evans.

IRELAND.

Antrim—Cushendun, May 1886 ! and Whitehall, Broughshane, June 1896 ! Rev. S. A. Brenan.
Armagh—Acton Glebe, Poyntz Pass, Sept. 1904 ! Rev. W. F. Johnson.
Tyrone—Omagh, July 1904 ! P. H. Grierson.
Donegal—Templemore Park, Sept. 1904 ! D. C. Campbell.
Meath—Drumcondra, July 1904 ! P. H. Grierson.
Dublin—Foxhall demesne, Raheny, abundant in a field, amongst horse-manure, evidently feeding on the fungi abounding there, Aug. 1890, R. F. Scharff.
Carlow—Fenagh House, Bagenalstown, Sept. 1904 ! Denis R. Pack-Beresford.
Kilkenny—Gardens, Bessborough, Piltown, Sept. 1904 ! Earl of Bessborough.
Mayo W.—At the "Colony," Achill Island, Sept. 1886 ! J. G. Milne. Dugort, July 1904 ! P. H. Grierson.
Clare—Doonass, Aug. 1904 ! R. A. Phillips.
Cork N.—Banks of river Lee, Cork, Sept. 1904 ! C. Baker.
Kerry—Valentia Island, Sept. 1904 ! Miss M. J. Delap.

CONTINENTAL DISTRIBUTION.

France—Sub-var. *cinerea*, Savoy (Dumont & Mortillet, op. cit.).

Belgium—Recorded for about Brussels, Vielsalm, Liége, Roumont, and other places. Sub-var. *ardosiarum*, at Arlon, Geichel, and Vielsalm (Colbeau, op. cit.). A grey variety in a wood at Forest near Brussels, April 1888 (Staes, Bull. Soc. Mal. Belg., 1868, p. 25).

Var. **ferussaci** Kaleniczenko (em) Bull. Mosc., 1851, p. 113.

Arion empiricorum var. κ Férussac, Hist. Moll., 1819, p. 62, pl. 1, f. 8.
Arion empiricorum ferussackii Kaleniczenko, op. cit.
Arion virescens Millet, Moll. Maine et Loire, 1854, p. 11.
Arion rufus var. *virescens* Moquin-Tandon, Hist. Moll., 1855, p. 11.
Arion olivaceus Schmidt, Verh. Naturh. Preuss, 1856, p. 58.

ANIMAL yellowish or orange, with lateral bands and dorsum greenish-grey, foot-fringe yellow.

The vars. **ferussackii** and **virescens** are really names applied to the var. κ of Férussac, to which form the var. *subdeleta* of Cockerell also belongs.

The sub-var. **olivacea** is described as olivaceous-brown and indistinctly fasciate.

WALES.

Montgomery—Under planks near bowling green, Welshpool, Aug. 1889 ! J. Bickerton Morgan.

CONTINENTAL DISTRIBUTION.

France—Sub-var. *virescens*, forests about Cholet, Angers, and Thorigné in the department Maine et Loire.

Austro-Hungary—Sub-var. *olivacea* is recorded by Bielz from beneath bark, under stones or fallen wood, at an elevation of 2,000 to 6,000 feet, in the mountain forests of Transylvania.

Russia—Var. *ferussaci*, in district of Achtyrka, Lebedin, and Zmiew, Kharkov.

Var. **alba** Esmark, Nyt Mag. Naturv., 1882, p. 98.

ANIMAL white, tinged with greyish on the back.

CONTINENTAL DISTRIBUTION.

Norway—Osterdalen, at an alt. of 2,300 ft. ; also at Tónset ; Lille Lombolen, Maalselven in Tromsó ; and Tromsóen and Porsangerfjord in Finmark (Esmark, J. of Conch., Oct. 1886).

Var. **succinea** Bouillet, Moll. Auvergne, 1836, p. 14.

Arion succineus Bouillet, op. cit.
Arion campestris Mabille, Rev. Mag. Zool., 1868, p. 134.
Arion citrinus Westerlund, Exposé Crit., 1871, p. 35.
Arion mabillianus Bourguignat, Moll. Nouv. lit., 1886, p. 173, pl. 29, f. 1-4.
Arion cinctus var. *aurantiacus* Dum. & Mort., Cat. Moll. Savoie, 1857, p. 7.
Arion rubiginosus var. *nigricans* Baudon, Mem. Limac. Oise, 1871, p. 5.
Arion krynickii Kaleniczenko, Bull. Mosc., 1851, p. 114, pl. 4, f. 1.
Arion cinctus var. *atripunctatus* Dum. & Mort., Mal. Sav., 1852, p. 7.
Arion fuscus var. *bœttgeri* Pollonera, Specie nuove ecc., 1887, p. 15, f. 11.
Arion flavus Pollonera, Arionidæ Reg. Paléarct., 1890, p. 15.
Arion rufus var. *lævis* Westerlund, Moll. Extram. Scand., 1897, p. 41.
Arion bavayi Pollonera, Spec. nuove ecc., p. 12, f. 15.

Animal of a yellow or orange colour, with or without a more or less distinct lateral band at each side.

The var. **succinea** s.str., is yellow, dorsum chestnut-brown, foot-fringe yellow with dark lineoles.

The sub-var. **citrina** is of a citron-yellow, duller dorsally, neck and tentacles blackish, and black foot-fringe lineolation.

The sub-var. **mabilliana** is ochraceous-yellow, with chestnut lateral banding.

The sub-var. **aurantiaca** is of an orange colour with darker dorsum and lateral banding.

The sub-var. **campestris** is orange-coloured without lateral bands, foot-fringe yellowish without lineoles, but spotted with orange.

The sub-var. **nigricans** has the ground-tint gamboge, but shows brown tentacles, lateral bands, and dorsum.

The sub-var. **krynickii** is dull yellow, with cinereous bands and whitish foot-sole.

The sub-var. **atripunctata** is yellow, dorsum darker, with black spots, lateral bands black, foot-fringe yellow with fuscous lineolation.

The sub-var. **bœttgeri** is yellow, dorsum chestnut or dark fuscous, sprinkled with black, lateral bands chestnut or blackish, foot-fringe yellow with black lineoles.

The sub-var. **flava** is deep or pale yellow, without or with only indistinct lateral banding and indistinct foot-fringe lineolation.

The sub-var. **lævis** is yellowish, with brownish-yellow dorsum, foot-fringe with fuscous lineolation.

The sub-var. **bavayi** is orange or yellow, dorsum fuscous, with black lateral band on each side, fringe yellow, lineolate with fuscous; dermal mucus colourless.

ENGLAND.

Surrey—Sub-var. *aurantiaca*, Shottermill (C. Pannell, J. of Conch., Jan. 1902).

Stafford—Stafford; canal side, Radford; and at Brewood, June, 1886! L. E. Adams. Hedgerows near Birmingham, F. J. Partridge and G. Breeden.

Cheshire—Common at Romiley, June 1896! C. Oldham.

Lancashire S.—Sub-v. *aurantiaca*, near Farington, June 1890! W. H. Heathcote.

York N.W.—Sub-var. *aurantiaca*, Islet Bridge, Aug. 1885! W. Denison Roebuck.

SCOTLAND.

Aberdeen S.—Garden, Rubislaw, Oct. 1904! G. Sim.

IRELAND.

Antrim—Cushendun, May 1886! Rev. S. A. Brenan. Abundant on Rathlin Island, and commoner than the type form at Murlough and other places on the north coast, May 1897, L. E. Adams. Sub-vars. *aurantiaca* and *campestris*, Belfast, Dec. 1891, R. F. Scharff.

Down—Sub-vars. *aurantiaca* and *campestris*, Cultra, Dec. 1891, R. F. Scharff.

Tyrone—Omagh, July 1904! P. H. Grierson.

Louth—Near Drogheda, Oct. 1904! P. H. Grierson.

Meath—Drumcondra, July 1904! P. H. Grierson.

Dublin—Garden, Sloperton Lodge, Kingstown, May 1886! W. F. de V. Kane. Sub-var. *flava*, Pine wood, Howth Hill near Dublin, and Killakee in the Dublin Mountains (R. F. Scharff, Slugs of Ireland, 1891, p. 544).

Wicklow—Bray Head (R. F. Scharff, op. cit.).

Sligo—Sub-var. *flava*, Collooney, Sept. 1885! W. F. de Vismes Kane.

Galway W.—Sub-var. *flava*, Renvyle and Kylemore, March 1891, R. F. Scharff.

Galway E.—Common in Clare-Galway Abbey, July 1895 (Standen, Irish Nat., Sept. 1895).

Tipperary S.—Sub-v. *aurantiaca*, Melview, Clonmel, Oct. 1904! Mrs. Malcolmson.

Waterford—Abundant, Glenabbey, and in ditches of Mountain road, Clonmel, May 1886, Rev. A. H. Delap.

Kerry—Sheen Wood and island in Middle Cloonee Lake, July 1898 (Standen, Irish Nat., Sept. 1898).

CONTINENTAL DISTRIBUTION.

Germany—Sub-var. *campestris*, Neu Brisach, Alsace. Sub-var. *bœttgeri*, Bremen (Pollonera, Arionidæ Rég. Paleárct., 1890, p. 13). Sub-var. *citrina*, Misdroy, Wollin Island, Pomerania (Babor, J. of Mal., 1894, p. 45).

France—In the elevated mountain woods of Puy-de-Dôme and Cantal (Bouillet, l.c.). Sub-var. *mabilliana*, in the Forest d'Orient in the Aube. Sub-var. *aurantiaca*, Savoy (Dumont & Mortillet, op. cit.). Sub-var. *nigricans*, on mushrooms, chiefly in October, in the Forest of Hez, department of the Oise; and Drouet has also found it at Dijon, Côte d'Or. Sub-var. *atripunctata*, Mont Saxonnet, Savoy, at an alt. of over 3,000 feet (Dum. & Mort., op. cit.). Sub-var. *campestris*, Bellancourt and Sévres, Seine. Sub-var. *bavayi*, Brest in Finistère.

Switzerland—Sub-var. *campestris*, St. Gall (Westerlund, op. cit.).

Italy—Sub-var. *atripunctata*, on the Alps, also Piano di Formazza, Piedmont (Pollonera, Arionidæ Rég. Paléarct., 1890, p. 13).

Norway—Elvanaes and Jarfjord (Esmark & Hoyer, Mal. Bl., 1886, p. 103). Sub-vars. *citrina* and *flava*, Ringerige (Westerlund, l.c.).

Sweden—Sub-var. *lævis*, Krokum in Jemtland. Sub-var. *citrina*, Ofvedskloster in Scania, and in Blekinge. Sub-var. *flava*, Esperod in Scania, rarely in Smaland, and in Blekinge (Westerlund, l.c.).

Denmark—Sub-var. *flava*, Copenhagen (Westerlund, l.c.).

Russia—Sub-var. *krynickii*, in moist woodlands near Ivanovka in Sumy district. Frequent in rainy weather by woodland roads, on *Morchellæ*, near Danilovka-Parva, Kurysch, and Kvitkin in the district of Kharkov (Kaleniczenko, l.c.).

Var. **pegorarii** Less. & Poll., Mon. Limac. Ital., 1882, p. 62.

Arion pegorarii Less. & Poll., op. cit.
Arion stabilei Pollonera, Elencho Moll. Terr. Piem., 1885, p. 28.
Arion polloneræ Pini, Nov. Malac., 1884, p. 42.
Arion subfuscus var. *transylvanus* Simroth, Zeitschr. Wissensch. Zool., 1885, p. 284.
Arion subfuscus var. *alpestris* Pollonera, Arionidæ Rég. Paléarct., 1890, p. 12.

ANIMAL quadrifasciate, showing dark subdorsal and lateral banding on each side.

The var. **pegorarii** s.str., is dusky rufous, confusedly quadrifasciate; foot-fringe dark grey, with black lineolations; sole whitish and mucus yellow. According to Pollonera, this form is also distinguished from the typical form by the presence of an additional ectocone to the marginal teeth.

The sub-var. **stabilei** is described as yellowish or orange, confusedly quadrifasciate; foot-fringe with black lineolations.

The sub-var. **polloneræ** grows to a larger size (80 mill.) and is confusedly quadrifasciate, with pale yellow fringe, and conspicuous lineolation.

The sub-var. **transylvana** is very darkly coloured and quadrifasciate.

The sub-var. **alpestris** is yellow or orange; dorsum more or less chestnut or fuscous-black; fascia blackish or chestnut coloured; fringe yellow, lineolate with fuscous.

CONTINENTAL DISTRIBUTION.

Germany—Sub-var. *alpestris* (Pollonera, op. cit.).

France—Sub-var. *alpestris*, north of France (Pollonera, op. cit.).

Italy—Etrouble, valley of Aosta, Piedmont. Sub-var. *polloneræ*, Intra on Lake Maggiore, Piedmont. Sub-var. *alpestris*, Alps; sub-var. *stabilei*, Maccugnaga, Piedmont (Pollonera, op. cit.).

Austro-Hungary—Sub-var. *transylvana*, Transylvania (Simroth, l.c.).

Sweden—Malm records a quadrifasciate variety from Lulea-Lappmark, which would perhaps be best placed under *pegorarii*.

Geographical Distribution.—*Arion subfuscus* has a more extended distribution than *A. ater*, as, in either its typical or in its aberrant forms its range extends on all sides beyond that of the latter species, forming as it were a fringe beyond the inhabited area of its congener.

The distributional area comprises almost the whole of Europe, except the south-eastern extremity, where *Arionidæ* are practically deficient.

It is recorded as inhabiting the British Isles, Germany, France, Belgium, Spain, Portugal, Switzerland, Northern Italy, Austro-Hungary, Russia,

Denmark, Sweden, and Norway, and it is not improbable that the slugs recorded as *Arion hortensis* from Siberia really appertain to this species.

It has also been noted from the United States, New Zealand, and other places, where it has been introduced by commerce.

In the British Isles, this species is well distributed throughout the country, except in East Anglia, where it is apparently absent, no authentic record of its occurrence within that area being known, nor have we ever seen an example therefrom.

This remarkable scarcity or absence from the East Anglian district, taken in conjunction with its increasing abundance westward and in Ireland, is strongly corroborative of *A. subfuscus* being one of the weaker and less adaptable species, which are being gradually but surely expelled from the eastern regions of this country.

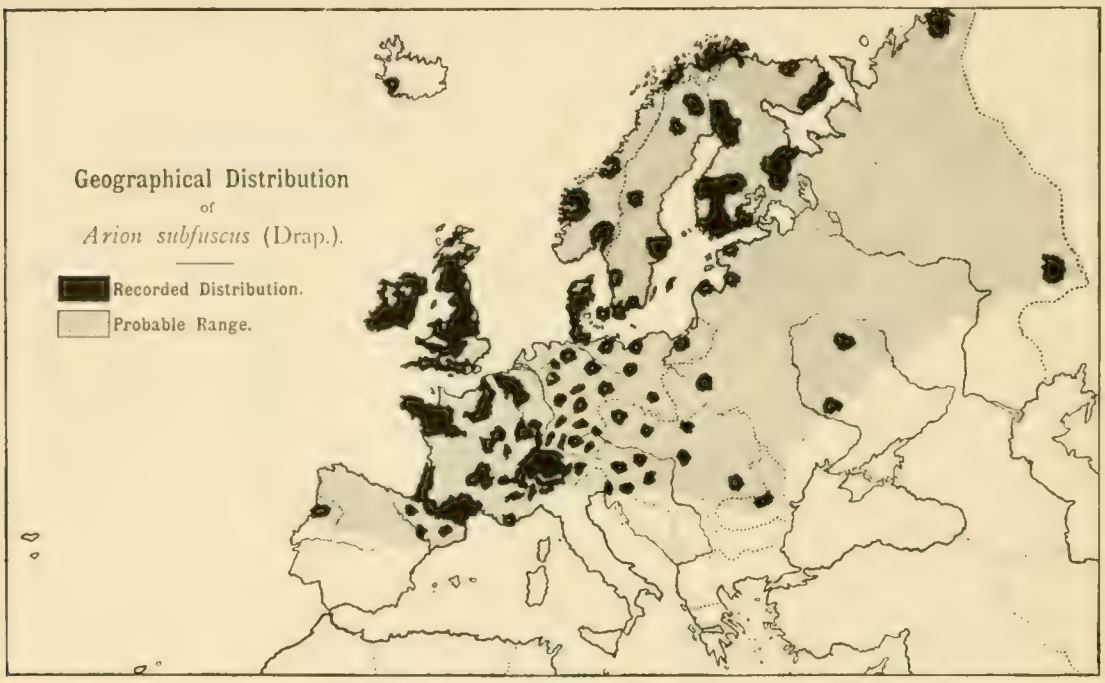


Fig. 220.

ENGLAND AND WALES.

Channel Isles—V. *cinereo-fusca*, St. Sampson's, Guernsey, Sept. 1891 ! B. Tomlin.

PENINSULA.

Cornwall W.—Trevedock rd., St. Columb, May 1885 ! W. Vinson. Penzance, Jan. 1905 ! L. E. Adams. Type and var. *cinereo-fusca*, Truro, May 1886 ! J. H. James.

Cornwall E.—Garden bank, and Queen's Hill, St. Columb, May 1885 ! W. Vinson.

Devon S.—Common at Topsham, Sept. 1892 ! Lionel E. Adams. Type and var. *cinereo-fusca*, Teignmouth, Oct. 1888 ! L. St. G. Byne.

Devon N.—Dartmoor, July 1889 ! W. A. Gain. Type and var. *cinereo-fusca*, Belstone near Okehampton, Sept. 1904 ! Rev. W. Wright Mason.

Somerset S.—Type and var. *brunnea*, allotment gardens near canal, Bridgwater, Aug. 1884 ! W. Vinson.

CHANNEL.

Wilts. N.—Manton near Marlborough, E. Meyrick, Sept. 1904.

Dorset—Chideock, Bridport, Aug. 1885! A. Belt. Portland, Aug. 1886 ! J. Madison. Stour Provost (E. W. Swanton, Nat. Journ., March 1902). Broadstone, Parkstone, July 1904 ! T. D. A. Cockerell. Var. *cinereo-fusca*, Montevideo, Chickerell, near Weymouth, Sept. 1904 ! Nelson M. Richardson.

Isle of Wight—Yarmouth, May 1887 ! C. Ashford.

Hants. S.—Garden, Christchurch, Nov. 1884 ! Burton, Apr. 1890 ; Roeshot Hill, June 1890 ; Bolderwood, Aug. 1887 ; and Southampton, C. Ashford. Hambledon, May 1904 ! C. S. Coles.

Hants. N.—Type and sub-var. *brunnea*, Preston Candover, Nov. 1885 ! Rev. H. P. Fitzgerald.

Sussex W.—Type and var. *cinereo-fusca*, Up Park, Aug. 1886 ! W. Jeffery.

THAMES.

Kent W.—Chislehurst, May 1885 ! T. D. A. Cockerell.

Surrey—Haslemere, Shottermill, Punch Bowl, and Grayswood ; sub-var. *aurantiaca*, Shottermill ; and sub-var. *brunnea*, Haslemere (C. Pannell, J. of C., Jan. 1902).

Middlesex—Type and var. *cinereo-fusca*, Muswell Hill road, Highgate, July 1888 ! and sub-var. *brunnea*, Churchyard Bottom wood, May 1889 ! H. W. Kew.

Oxford—Plentiful and well distributed, varying much in colour, usually much paler in the southern parts of the county (W. E. Collinge, Conch., 1891, p. 13).

ANGLIA.

Northampton—By no means common, Harlestone, May 1893 ! Yardley Chase and Desborough, L. E. Adams. Haselbeech, Rev. W. A. Shaw, Sept. 1904.

SEVERN.

Gloucester W.—Stroud, Oct. 1883 ! E. J. Elliott.

Monmouth—Type and var. *cinereo-fusca*, banks of Wye, Monmouth, July 1891 ! W. Whitwell. Type and var. *cinereo-fusca*, garden, Rose Cottage, Talywain, July 1904 ! J. Manners.

Worcester—Sub-var. *grisea*, W. E. Collinge, Jan. 1905.

Warwick—Dudley Castle, 1896, H. Overton. Sutton Coldfield, 1897, A. Wood. Sub-var. *grisea*, W. E. Collinge, Jan. 1905 ; also a form of sub-var. *flagella*, Sutton Coldfield, H. Overton (id., Journ. of Mal., Dec. 1904).

Stafford—Froghall, April 1889 ! T. F. Burrows. Fir woods near Cheadle, April 1889 ! J. R. B. Masefield. Newton road, near Birmingham, July 1893 ! C. Oldham. Var. *succinea*, hedgerows near Birmingham, F. J. Partridge and G. Breeden. Type and var. *succinea*, Stafford ; canal side, Radford ; and Brewood, June 1886 ! L. E. Adams.

Salop—Type and sub-var. *brunnea*, Oswestry, June 1885 ! B. Hudson.

SOUTH WALES.

Glamorgan—Cardiff, 1888; sub-var. of *bicolor* by river Ely, St. Fagan's, March 1885 ! F. W. Wotton.

Brecon—Var. *cinereo-fusca*, Erwood, Oct. 1904 ! J. Williams Vaughan.

Carmarthen—Var. *cinereo-fusca*, Llanelly, Sept. 1904 ! H. Rowland Wakefield.

Pembroke—Plantation, Heywood lane, Tenby, A. G. Stubbs. Haverfordwest, Sept. 1904 ! Price Davies. Type, var. *cinereo-fusca*, and sub-var. *brunnea*, Pembroke, June 1885 ! Mrs. Trayler.

NORTH WALES.

Montgomery—Etail-wag, June 1885 ! Baker Hudson. Sarnau near Welshpool (J. B. Morgan, Moll. Montgomery, 1891). Type and var. *ferussaci*, timber yard, Welshpool, June 1889 ! J. B. Morgan.

Merioneth—Nant-y-Mor, June 1901 ! W. Denison Roebuck.

Carnarvon—Llangelynen, July 1883 ! W. Denison Roebuck. Abersoch, June 1896, C. Oldham. Yr Aran, Snowdon, Aug. 1891 ! H. P. Marshall. Var. *cinereo-fusca*, slopes of Snowdon, April 1887 ! J. Madison.

Denbigh—Common on low-lying ground, Bont-ddu near Dolgelly (Fenn, J. of C., July 1887, p. 198). Colwyn Bay, April 1897 ; common, Bettws-y-Coed, May, 1898 ; abundant, Nant Glyn, May 1904, C. Oldham.

TRENT.

Lincoln S.—Fulbeck Grange, Dec. 1888 ! J. Burtt Davy. Careby Wood near Grantham, June 1903 ! H. W. Kirkby.

Lincoln N.—Well Vale, Sept. 1889 ! W. Denison Roebuck. Farlesthorpe (J. Burtt Davy, Garner, May 1891). Var. *cinereo-fusca*, Ulceby-with-Fordington, Oct. 1889 ! J. Burtt Davy.

Notts.—Cleveland Hill, West Markham, April 1884 ! C. T. Musson. Type and sub-var. *brunnea*, garden, Tuxford, April 1885 ! W. A. Gain.

Derby—Marple, May 1885 ! and Buxton, May 1893 ! C. Oldham. Darley Dale, June 1890 ! W. H. Heathcote. Winster, June 1885 ! Rev. H. Milnes. Near Hathersage, Aug. 1890 ! type and sub-var. *brunnea*, Clifton, Sept. 1889 ! L. E. Adams.

MERSEY.

Cheshire—Bowdon, Sept. 1884 ! and Hale, May 1885 ! J. G. Milne. Garden, Heatley House, Sept. 1885 ! L. E. Adams. Marple, May 1891 ! L. St. G. Byne. Sale and Northenden, June 1885 ! and at Baguley Hall, Sept. 1892 ! also type and var. *succinea*, Romiley, June 1896 ! C. Oldham.

Lancashire S.—Hough Green near Widnes, March 1884 ! H. L. Edwards. Near Preston, June 1888 ! sub-var. *aurantiaca*, abundant along a roadside hedgerow, Farington, June 1890 ! W. H. Heathcote. Type and sub-var. *grisea*, Knowsley (W. E. Collinge, J. of Mal., June 1893, p. 148).

Lancashire Mid—Over Wyresdale, alt. 1,000 ft., April 1903 ! Rev. W. W. Mason. Broughton near Preston, July 1904 ! W. H. Heathcote.

HUMBER.

York S.E.—Filey, 1903; banks of canal, Beverley, J. D. Butterell.

York N.E.—Wilton Wood, May 1887 ! Beedale, June 1901 ! Harwood Dale and Breaday Gill, May 1904 ! Bowes, July 1884 ! W. Denison Roebuck. Hayburn Wyke, Aug. 1894, F. W. Fierke. Type and var. *cinereo-fusca*, Ingleby Greenhow, Sept. 1890 ! Rev. J. Hawell.

York S.W.—Common, Lofthouse, May 1887, Geo. Roberts. In and around garden, Rose Hill, Penistone, Nov. 1889 ! L. E. Adams. Bell Hogg near Sheffield, June 1893 ! C. Oldham. Wheatley Wood, Doncaster, April 1904 ! H. H. Corbett. Hebden Bridge, June 1904 ! W. Denison Roebuck. Common at Elland Park wood; Jagger Green; Howroyd Clough and Red Lane Dyke, Halifax, J. E. Crowther, Halifax Nat., Aug. 1903, p. 49.

York Mid W.—Gardens and fields near canal, Saltaire, Nov. 1883 ! marshy field in Tong Park, 1887; Esholt and Fagley, 1888; Calverley Wood and Shipley Glen, 1889, H. T. Soppitt. Manston, May 1904 ! W. H. Hutton. Eavestone, Sept. 1886 ! J. Ingleby. Mickley Wood, Aug. 1889 ! W. Denison Roebuck. Buttertubs Pass, alt. 1,500 feet, May 1904 ! H. Wallis Kew. Grassington, Sept. 1900, F. Rhodes. Waterfall, Crook Gill, Buckden, Aug. 1904 ! A. H. Pawson.

York N.W.—Horton-in-Ribblesdale, May 1892 ! W. D. Roebuck. Ingleton (Collinge, Nat., 1890, p. 198). Hammerton Hall, Bolland, Aug. 1885 ! and sub-var. *aurantiaca*, Islet Bridge, Aug. 1885 ! W. Denison Roebuck.

TYNE.

Durham—Durham, April 1884 ! Baker Hudson. Harwood Dale, Aug. 1889, W. Denison Roebuck.

Northumberland—Gosforth, Aug. 1904 ! Mrs. Willans. Type and sub-var. *brunnea*, Stocksfield-on-Tyne, May 1885 ! H. E. Craven.

LAKES.

Westmorland and Lake Lancashire—Coniston Old Man, July 1887 ! S. C. Cockerell. Holywath, Coniston, Oct. 1886 ! W. Denison Roebuck. Var. *cinereo-fusca*, Grasmere, June 1886 ! C. Oldham. Sub-var. *grisea*, Grange, 1897 (Fowler, Journ. of Mal., 1899, p. 38).

Cumberland—Keswick, July 1903 ! Rev. R. Godfrey. Sub-var. *brunnea*, Skiddaw Forest, Sept. 1890 ! Rev. J. Hawell.

Isle of Man—Glen Maye and Keppel Gate, Snaefell, Sept. 1891 !

SCOTLAND.

WEST LOWLANDS.

Dumfries—Type and var. *cinereo-fusca*, Moffat, Jan. 1891 ! W. Evans.

Kirkcudbright—Castle Douglas, Sept. 1890 ! W. Evans.

Ayr—Adneil, Nov. 1903, Rev. R. Godfrey.

Renfrew—Var. *cinereo-fusca*, Braidland, Aug. 1890 ! J. M. B. Taylor.

Lanark—Wilderness Wood, Cadder, Aug. 1886 ! W. Denison Roebuck. Type and sub-var. *brunnea*, Blackwood estate, Kirkmuirhill, Sept. 1904 ! N. B. Kinnear.

EAST LOWLANDS.

Peebles—Leadburn, about disused farm buildings, July 1889 ! W. D. Roebuck. West Lynton ! Lyne ! and Standalane near Peebles, July 1890 ! W. Evans.

Selkirk—Holylee, July 1889 ! W. Denison Roebuck. Var. *cinereo-fusca*, near Selkirk, Oct. 1890 ! W. Evans.

Roxburgh—Type, var. *cinereo-fusca*, and sub-var. *brunnea*, Jedburgh, Sept. 1904 ! J. Roseburgh.

Berwick—*Arion subflavus* frequent in woods and shady places (G. Johnston, Berwick N. C. Proc., 1838, p. 154). Eyemouth, W. Evans. Var. *cinereo-fusca*, Dryburgh, July 1889 ! W. Denison Roebuck.

Haddington—Aberlady, May 1890 ! Westbarn Links near Dunbar, Sept. 1894 ! Luffness Links, May 1890 ! W. Evans.

Edinburgh—Abundant by field-paths, Craiglockhart near Edinburgh July 1889 ! W. Denison Roebuck. Near Balerno, April 1890 ! Caroline Park, Granton, Nov. 1890 ! The Bush, Penicuik, Dec. 1890 ! and Kirknewton, Feb. 1897, W. Evans. Var. *cinereo-fusca*, Braidburn ! W. E. Clarke.

Linlithgow—About Linlithgow, Oct. 1890 ! Binny Craig, Mch. 1898; and Bonnytown Hills, Aug. 1901, W. Evans. Fairly common in the county and noted at Blackness, Carriden, Preston, Livingston, Kinneil Mill, Graeme's Dyke, Bankhead, and Bo'ness, Rev. R. Godfrey.

EAST HIGHLANDS.

Fife and Kinross—Otterston, June 1890 ! Dura Den, July 1890 ! Falkland Woods, Aug. 1895; Loch Leven, Feb. 1896; also type and var. *cinereo-fusca*, Loch Gelly, May 1895, W. Evans. Sub-vars. *lateritia* and *grisea*, Mount Melville, St. Andrews (W. E. Collinge, l.c.).

Stirling—Cambusbarron, Stirling, July 1894 ! A. McLellan.

Perth S. and Clackmannan—South slope of Drummond Hill ! Dollar, April 1897 ; Callander, May 1894 ! and Aberfoyle, April 1896, W. Evans. Balquhidder, July 1904 ! Rev. R. Godfrey.

Perth Mid—Crianlarich, Aug. 1888 ! Alex. Somerville. Inver Dunkeld, Sept. 1904 ! A. Rodgers. Var. *cinereo-fusca*, Glen Ogle, Lochearnhead, June 1904 ! Rev. R. Godfrey. Var. *cinereo-fusca* and sub-var. *brunnea*, Dunkeld road, Perth, Sept. 1904 ! W. Evans.

Perth N.—Fenderbridge, Glen Tilt, Sept. 1898 ! and Blairgowrie, July 1890 ! W. Evans.

Kincardine—Banchory, July 1890 ! W. Evans.

Aberdeen S.—Drum Woods, Deeside, Oct. 1886 ! C. B. Plowright. Aberdeen Links, July 1890 ! W. Evans. Banks of Don near Aberdeen, Sept. 1904 ! var. *succinea* and sub-var. *brunnea*, garden, Rubislaw, Oct. 1904 ! G. Sim.

Banff—Banks of Avon above Ballindalloch, Sept. 1891 ! W. Evans.

Elgin—Below Grantown, Strathspey, Aug. 1891 ! W. Evans.

Easterness—Dalwhinnie, alt. 1,200 ft., June 1892 ! W. Evans. Var. *rufo-fusca*, Rothiemurchus pine forest, Aug. 1904 ! Rev. R. Godfrey.

WEST HIGHLANDS.

Main Argyle—Dunoon ! and Ardenadam ! W. Denison Roebuck. Ballineanoch, Sonachan, Barbreek, Lochan Dubh near Oban, Dunollie, Ganavan, Glen Sheileach, Gallanach road, and on the moor near Benbeg, July 1901, Rev. R. Godfrey.

Clyde Isles—Isle of Arran: Brodick, April 1895 ! W. Evans ; and Loch Greenan, July 1889 ! W. Denison Roebuck. Isle of Bute: near the aquarium, Rothesay, Nov. 1886 ! T. Scott.

Cantire—About old castle, Tarbert, April 1886 ! T. Scott.

NORTH HIGHLANDS.

Ross W.—Ullapool, Aug. 1886 ! Alex. Somerville.

Sutherland E.—South side of Little Dornoch, Oct. 1884 ! and Blue Rock, Brora, March 1885 ! W. Baillie.

IRELAND.

ULSTER.

Derry—Moderately common by banks of river Bann, Coleraine, Nov. 1883, L. E. Adams. Ballynagard, June 1892 ; and Gortness, Sept. 1904 ! D. C. Campbell. Creagh meadows, Toome, June 1893; shores of Lough Neagh, June 1899; and under logs on railway embankment, Limavady Junction, March 1903, R. Welch.

Antrim—Collooney, Sept. 1885 ! W. F. de Vismes Kane. Dunluce Castle and old church, Sept. 1893 ; Cave Hill, 1893 ; large and common at Plantation Port, Kenbane, Oct. 1898 ; stream-side, Whitepark Bay, June 1899 ; common and finer than usual, Brown's Bay, Larne, July 1899 ; Colin Glen, Nov. 1899 ; Bush Bay, Jan. 1900 ; Glencorp, March 1900 ; common about Armoy, Glenshesk, and the Ballycastle district generally, R. Welch. Abundant about Murlough Bay, Cushendun, and all along the north coast of Antrim ; also on Rathlin Island, and at Loughaveena, at 900 ft. alt., in the midst of a bog, in company with *Arion ater*. In some localities the sub-var. *aurantiaca* is far commoner than the type, May 1897, L. E. Adams. Type and sub-vars. *aurantiaca* and *campestris*, Belfast, Dec. 1891, R. F. Scharff. Var. *cinereo-fusca*, Ballycastle, Oct. 1904 ! Miss F. S. O'Connor. Vars. *cinereo-fusca* and *succinea*, Cushendun, May 1886 ! and var. *cinereo-fusca*, Whitehall, Broughshane, June 1896 ! Rev. S. A. Brenan.

Down—Beech Hill near Newry, July 1904 ! R. J. Anderson. Clonduff, Hilltown and Ballinoe Stone-circle, Jan. 1898 ; very common on rockery, Oakleigh, Ormeau Park, Belfast, May 1898 ; common on fallen trees by Hillsborough Monument, April 1899 ; and common under logs, Helen's Bay, Sept. 1904, A. W. Stelfox and R. Welch. Finnebrogue Woods, Dec. 1900 ; and rare on shores of Lough Aghery, May 1904, R. Welch. Type and sub-vars. *aurantiaca* and *campestris*, Cultra, Dec. 1891, R. F. Scharff.

Armagh—Type and sub-var. *brunnea*, Armagh, June 1885 ! Rev. H. W. Lett. Var. *cinereo-fusca*, Acton Glebe, Poyntz Pass, Sept. 1904 ! Rev. W. F. Johnson.

Monaghan—Carrickmacross, Sep. 1904 ! also type and sub-var. *brunnea*, Drumreaske, Sept. 1904 ! W. F. de Vismes Kane.

Tyrone—Baronscourt, Sept. 1904 ! R. Bell. Sion Mills, Feb. 1900, R. Welch. Var. *cinereo-fusca* and sub-var. *aurantiaca*, Omagh, July 1904 ! P. H. Grierson.

Donegal—Ardara Woods, April 1900, R. Welch. Var. *cinereo-fusca*, Templemore Park, Sept. 1904 ! D. C. Campbell.

Cavan—Mullagh, July 1904 ! P. H. Grierson.

LEINSTER.

Louth—Woods and fields, Piperstown, Oct. 1889 ! Miss S. Smith. Dromiskin, June 1904 ! Narrow Water, Dec. 1904 ! var. *brunnea*, Blackhall Demesne, Sept. 1904 ! and sub-var. *aurantiaca*, Drogheda, Sept. 1904 ! P. H. Grierson.

Meath—Large at Slane Hill, July 1900, Rev. A. M. Norman and R. Welch. Grange, June 1892, R. F. Scharff. Var. *cinereo-fusca* and sub-var. *aurantiaca*, Drumcondra, July 1904 ! P. H. Grierson.

Dublin—Dublin, March 1886 ! J. R. Redding. Fairly common in Bushey Park, Dublin, Sept. 1903 (Welch and Stelfox, Irish Nat., June 1904, p. 123). Var. *succinea*, Sloperton Lodge, Kingstown, May 1886 ! W. F. de Vismes Kane. Var. *cinereo-fusca*, Foxhall Demesne, Raheny, Aug. 1890 ; also sub-var. *flava*, Howth, Sept. 1890 ; and Killakee, Dublin Mountains, Feb. 1891, R. F. Scharff.

Kildare—Sub-var. *brunnea*, Naas, Oct. 1904 ! R. J. Pack-Beresford.

Wicklow—Common on beech trees in Glen of Downs, July 1891 ; Little Sugar-Loaf Mountain, July 1891 ; Woodenbridge and sandhills, Arklow, March 1893; type and var. *succinea*, Bray Head, R. F. Scharff. Powerscourt, May 1886 ! W. F. de Vismes Kane. Enniskerry, Aug. 1904 ! P. H. Grierson.

Wexford—Kilmanock, Sept. 1890 ! G. E. Barrett-Hamilton.

Carlow—Var. *cinereo-fusca*, Fenagh House, Bagenalstown, Sept. 1904 ! Denis R. Pack-Beresford.

Kilkenny—Var. *cinereo-fusca*, gardens, Piltown, Sept. 1904 ! Earl of Bessborough.

Queen's Co.—La Bergerie, Aug. 1840, Rev. B. J. Clarke. Stradbally, Sept. 1904 ! A. G. Stuart.

King's Co.—Gardens, Charleville Forest, Tullamore, Sept. 1904 ! R. McKenna.

Westmeath—Common, Knockdrin Demesne, April 1892, R. F. Scharff.

Longford—Currygrane, Nov. 1901, Mrs. J. Mackay Wilson (Welch, Irish Nat., July 1902).

CONNAUGHT.

Roscommon—Mote Park, Sept. 1904 ! Lord Crofton.

Leitrim—Mohill, July 1904 ! P. H. Grierson. Swiss Valley, Glencar, July 1904 ! A. W. Stelfox.

Sligo—Rare, Sligo and Ballysodare, Sept. 1900, A. W. Stelfox. Raghly Point and Lissadill, July 1904, R. Welch. Sub-var. *flava*, Collooney near Sligo, Sept. 1885 ! and sub-var. *brunnea*, Rockwood, Lough Gill, Oct. 1886 ! W. F. de V. Kane.

Mayo W.—In ruined cottage, Slievemore, Sept. 1886 (J. G. Milne, J. of Conch., Oct. 1891). Ballina, Miss Amy Warren (W. E. Collinge, Irish Nat., May 1896, p. 144). Type and sub-var. *brunnea*, Enniscoe Demesne, Crossmolina, Sept. 1885 ! W. F. de Vismes Kane. Var. *cinereo-fusca*, Dugort, July 1904 ! P. H. Grierson.

Galway W.—Roundstone, also sub-var. *flava*, Renvyle and Kylemore, March 1891, R. F. Scharff. Var. *cinereo-fusca* and sub-var. *brunnea*, Kylemore Castle Gardens, Sept. 1904 ! W. Comfort.

Galway E.—Woodyard, Clonbrock, June 1896, Hon. R. E. Dillon and R. Welch. Type and sub-var. *aurantiaca*, common in Clare-Galway Abbey, July 1895 (R. Standen, Irish Nat., Sept. 1895, p. 267).

MUNSTER.

Clare—Woodpark, Scariff, Sept. 1904 ! N. F. Hibbert. Cratloe, Sept. 1904 ! and var. *cinereo-fusca*, Doonass, Aug. 1904 ! R. A. Phillips.

Limerick—Castle Connell, July 1904 ! R. A. Phillips.

Tipperary N.—Shores of Lough Derg, Sept. 1904 ! G. J. Fogerty.

Tipperary S.—Type and sub-var. *aurantiaca*, Melview, Clonmel, Oct. 1904 ! Mrs. Malcolmson.

Waterford—Kilmanock, Aug. 1904 ! G. E. H. Barrett-Hamilton. Type and var. *aurantiaca*, Glenabbey and Mountain road, Clonmel, Sept. 1886 ! Rev. A. H. Delap.

Cork N.—Var. *cinereo-fusca*, north bank of river Lee, Cork, Sep. 1904 ! C. Baker.

Cork S.—Rare on banks of river Lee, Cork, July 1904, R. Welch. Moderately common at Blarney Castle and Bantry, Sept. 1898, Lionel E. Adams. Sub-vars. *flagella* and *phillipsi*, Schull, July 1893 (W. E. Collinge, l.c.).

Kerry—Common, Glengariff and Kenmare, Sep. 1898, L. E. Adams. Gt. Skellig, Rev. A. H. Delap. Type, var. *cinereo-fusca*, and sub-var. *brunnea*, Valentia Island, Sept. 1904 ! Miss M. J. Delap. Var. *succinea*, Sheen Wood, and island in Middle Cloonee Lake, July 1898 (R. Standen, Irish Nat., Sept. 1898).

GERMANY.

This species is said to be found throughout Germany, but is rare in the north ; it is often found amongst fungi in the heathy pine forests, and has been definitely reported from Alsace, Bremen, Brandenburg, Baden, Bavaria, Cassel, Franconia, Hanover, Holstein, Lausitz, Lorraine, Mecklenburg, Nassau, Osnabruck, Pomerania, Pyrmont, Swabia, Saxony, Schleswig, Silesia, Westphalia, and Wurtemburg.

Distribution of *Arion subfuscus* (Drap.)

In the Counties and Vice-Counties of the British Isles.

ENGLAND AND WALES.

Channel Isles

PENINSULA
1 Cornwall W.
2 Cornwall E.
3 Devon S.
4 Devon N.
5 Somerset S.
6 Somerset N.

CHANNEL
7 Wilts N.
8 Wilts S.
9 Dorset
10 Isle of Wight
11 Hants S.
12 Hants N.
13 Sussex W.
14 Sussex E.

THAMES
15 Kent E.
16 Kent W.
17 Surrey
18 Essex S.
19 Essex N.
20 Herts.
21 Middlesex
22 Berks.
23 Oxford
24 Bucks.

ANGLIA
25 Suffolk E.
26 Suffolk W.
27 Norfolk E.
28 Norfolk W.
29 Cambridge
30 Bedford
31 Hunts.
32 Northampton

SEVERN
33 Gloucester E.
34 Gloucester W.
35 Monmouth
36 Hereford
37 Worcester
38 Warwick
39 Stafford
40 Salop

SOUTH WALES
41 Glamorgan
42 Brecon
43 Radnor
44 Carmarthen
45 Pembroke
46 Cardigan

NORTH WALES
47 Montgomery
48 Merioneth
49 Carnarvon
50 Denbigh
51 Flint
52 Anglesey

TRENT
53 Lincoln S.
54 Lincoln N.
55 Leic. & Rutld.
56 Notts.
57 Derby

MERSEY
58 Cheshire
59 Lancashire S.
60 Lan'shire Mid

HUMBER
61 S.E. York
62 N.E. York
63 S.W. York
64 Mid W. York
65 N.W. York

TYNE
66 Durham
67 Northumb. S.
68 Cheviotland

LAKES
69 Westmorland and L. Lancs.
70 Cumberland
71 Isle of Man

SCOTLAND.

W. LOWLANDS
72 Dumfries
73 Kirkcudbright
74 Wigtown
75 Ayr
76 Renfrew
77 Lanark

E. LOWLANDS
78 Peebles
79 Selkirk
80 Roxburgh
81 Berwick
82 Haddington
83 Edinburgh
84 Linlithgow

E. HIGHLANDS
85 Fife & Kinross
86 Stirling
87 Pth. S. & Clkn.
88 Mid Perth
89 Perth N.
90 Forfar
91 Kincardine
92 Aberdeen S.

E. HIGHLANDS
93 Aberdeen N.
94 Banff
95 Elgin
96 Easterness

W. HIGHLANDS
97 Westerness
98 Main Argyle
99 Dumbarton
100 Clyde Isles
101 Cantire
102 Ebudes S.
103 Ebudes Mid
104 Ebudes N.

N. HIGHLANDS
105 Ross W.
106 Ross E.
107 Sutherland E.
108 Sutherland W.
109 Caithness

NORTH ISLES
110 Hebrides
111 Orkneys
112 Shetlands

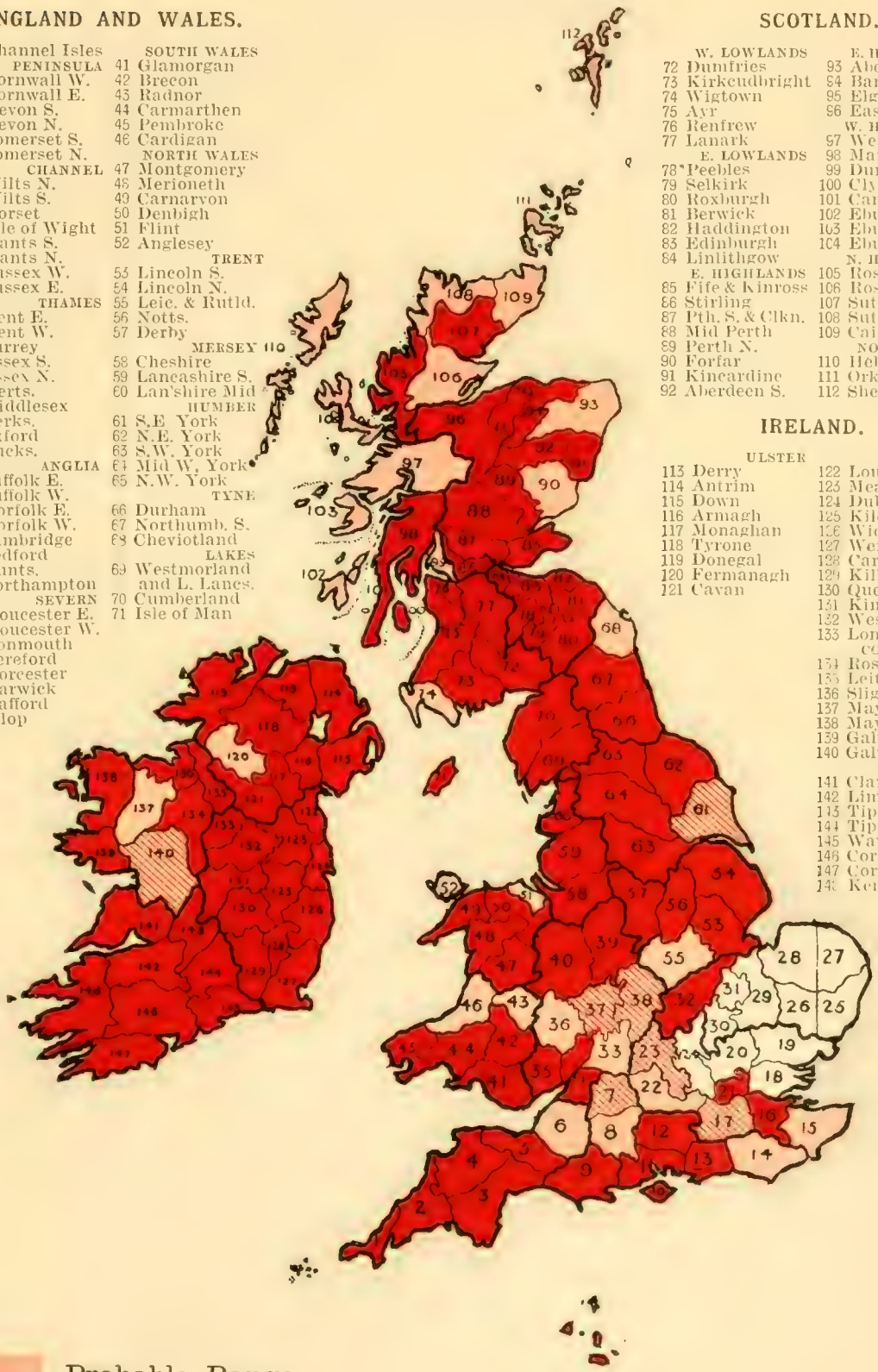
IRELAND.

ULSTER
113 Derry
114 Antrim
115 Down
116 Armagh
117 Monaghan
118 Tyrone
119 Donegal
120 Fermanagh
121 Cavan

LEINSTER
122 Louth
123 Meath
124 Dublin
125 Kildare
126 Wicklow
127 Wexford
128 Carlow
129 Kilkenny
130 Queen's Co.
131 King's Co.
132 Westmeath
133 Longford

CONNAUGHT
134 Roscommon
135 Leitrim
136 Sligo
137 Mayo E.
138 Mayo W.
139 Galway W.
140 Galway E.

MUNSTER
141 Clare
142 Limerick
143 Tipperary N.
144 Tipperary S.
145 Waterford
146 Cork N.
147 Cork S.
148 Kerry



Probable Range.

Recorded Distribution.

Distribution verified by the Authors.

NETHERLANDS.

Belgium—Recorded from Brabant, Liége, Luxemburg, Namur, etc.

FRANCE.

Arion subfuscus is recorded from the following departments or districts, but is said to be most abundant in the southern and central regions:—Aube, Aude, Ariège, Basses Pyrénées, Cantal, Champagne Meridionale, Côtes-du-Nord, Côte d'Or, Finistère, Gironde, Hautes Alpes, Haute Garonne, Haute Loire, Hautes Pyrénées, Hérault, Ille-et-Vilaine, Isère, Landes, Loire Inférieure, Maine et Loire, Morbihan, Moselle, Niévre, Oise, Pas-de-Calais, Puy-de-Dôme, Pyrénées Orientales, Savoie, Seine, Seine et Oise, Somme, Tarn, Var, and Vosges. Sub-var. *fuscata* in woods around Paris, department of the Seine.

SWITZERLAND.

This species has been recorded from the cantons of Aargau, Lucerne, Solothurn, St. Gall, and the Grisons; the sub-var. *gaudefroyi* from St. Gall.

ITALY.

Arion subfuscus is, according to Pollonera, confined to the hilly regions of the north, and the records of this species for Central and Southern Italy are due to errors of determination.

SPAIN AND PORTUGAL.

Spain—*Arion subfuscus* is recorded from several places in Catalonia, and from Aragon and Navarra by Fagot.

Portugal—*Arion fuligineus* is recorded by Morelet from a roadside wall near Ponte do Lima in the province of Douro.

BALKAN PENINSULA.

Roumania—Indicated by Simroth as an inhabitant of Roumania.

AUSTRO-HUNGARY.

Recorded as found in Austria, Bohemia, Carinthia, Carniola, Goritz, Hungary, Moravia, Styria, Tyrol, and Transylvania.

SCANDINAVIA.

Norway—Found throughout Norway as far north as North Cape, 71° 8′ north latitude, and Stangenæs at the mouth of the Tana in East Finmark. It is common on Tromsoen and Ando, and also about Trondjhem, Bergen, and Christiania.

Sweden—This species is found almost throughout Sweden, and has been noted as far north as Ofver-Lulea in Norbotten; it is also recorded from Jemtland; about Stockholm in Svealand; in Gothland at Ronneby, Gothenburg, and Christianstadt; near Frollinge in Halland, Balsberg in North Scania, and the Island of Bornholm.

Denmark—Common in Zealand, and rare in Jutland. It is also reported from **Iceland** and the **Faroes**.

RUSSIA.

Found throughout European Russia, extending eastwardly to the Ural Mountains about the 65th parallel, and also over the Arctic and wooded northern districts, having been found by Wallenberg near the coast on the shores of the arctic sea in Russian Lapland, at 69° north latitude. It is plentiful about Reval in Esthland; Dorpat in Livland; in Courland; in the Ukraine; about Moscow; and in many localities about Warsaw in Poland. It is met with in the Aland Isles, also throughout Finland, the specimens inhabiting the tract adjoining the Gulf of Finland having been distinguished as var. *fennica*, but have been recorded by others from thence as *Arion ater*.

Sub-var. *fuscata*, according to Kaleniczenko, inhabits shady woods about Nejin and Borozda, Tschernigov; and moist woods about Izium, Kharkov.

Siberia—Under the name of *A. hortensis*, Schrenk describes what is probably this species as generally distributed in Amurland; on the Lower Amur, it was found in damp deciduous woods near Teutscha, and at Dshare. It is also probable that the *Arion* collected by Dr. Theel in June and July, 1876, at Mikoulina on the Jenissei, are properly referable to *Arion subfuscus*.

NEARCTIC REGION.

New York—*Arion fuscus*, Lloyd's Neck, Long Island (H. Prime, Oct. 1895).

Massachusetts—*A. fuscus*, in yards and gardens, New Bedford; (J. H. Thomson, J. of Conch., Oct. 1885); gardens between Chestnut and Mount Vernon streets, above Willow street, and elsewhere in Boston (W. G. Binney, Manual Amer. Land Shells, 1885, p. 459).

AUSTRALASIAN REGION.

New Zealand—*Arion fuscus* Müll. introduced into New Zealand (Hutton, Trans. N.Z. Inst., xvi., p. 211).

Arion hortensis Férussac.

1819 **Arion hortensis** Férussac, Hist. Moll., p. 65, pl. 2, ff. 4, 5.
1826 — *lineatus* Risso, Hist. Nat. Eur. Merid., p. 55.
1855 — (*Prolepis*) *fuscus* Moq.-Tand., Hist. Moll. France, p. 14, pl. 1, ff. 28-30.
1866 — *anthracius* Bourg., Moll. nouv. lit., etc., p. 178, pl. 29, ff. 8-10.
1870 — *pelophilus* Mabille, Ann. Malac., p. 117.
1870 — *distinctus* Mabille, op. cit., p. 119.
1881 — *pyrenaicus* Fagot, in Gourdon. Moll. Luchon, p. 82.
1883 — *alpinus* Fitz., Syst. Verz. Oesterr. Weichth.
1889 — *cottianus* Pollonera, Contr. Studio *Arion* Europ., p. 14, ff. 23, 24.
1894 — *elongatus* Collinge, Ann. and Mag. Nat. Hist., p. 66, pl. 5a.
1897 — *cæruleus* Collinge, Proc. Zool. Soc., p. 444, pl. 31, ff. 18, 19.
1821 *Limax subfuscus* Pfeiffer, Syst. Anord., p. 20.
1868 *Prolepis hortensis* Malm, Limac. Scand., p. 49, pl. 2, f. 5.
1873 *Kobeltia hortensis* Seibert, Nachr. Deutsch. Mal. Ges., p. 81.

E. J Lowe

HISTORY.—*Arion hortensis* (*hortensis*, a garden) was first found in this country in 1817, by Dr. Leach, who placed specimens in the National Collection; its occurrence was, however, not published until 1821, when Dr. Gray added the species to the British list in the pages of the Medical Repository.

It is probably in part the *Limax fasciatus* of Nilsson, and according to Férussac the vestigial shell is the *Limacella concava* of Brard.

This species has been separated from *Arion ater* and *A. subfuscus* by Moquin-Tandon and others, and placed in a group *Prolepis*, which is characterized by possessing a more completely formed shell than is said to be present in the two former species. This character is, however, quite illusory, as is also their separation based upon the modification of the genital atrium, as proposed by Dr. Simroth.

This species is associated with Mr. E. J. Lowe, F.R.S., of Shirenewton Hall, Chepstow, the famous fern specialist, and author of many esteemed works thereon, in acknowledgment of the excellence of his "Conchology of Nottingham," published in 1853, and of his exceptional knowledge of the specific characters and habits of our British slugs.

Diagnosis.—*Arion hortensis* may be distinguished from *Arion ater* and *Arion subfuscus* by its much smaller size and different shade of colouring. From *Arion circumscriptus* it is separable by its tough, leathery integument, its more slender form, orange foot, black dorsum, and the more indistinctly defined black lateral bands, which are also less dorsally placed than in that species.

As Dr. Scharff has pointed out, it can be distinguished from similarly sized specimens of *Arion ater* by its dark colouring, the young of *ater* being usually light coloured, and the wrinkles longer and broader, while *A. intermedius* is readily separable by the possession of the peculiar little conically-pointed body wrinkles, which have earned for it the title of the "hedgehog snail."

INTERNALLY, this species is distinctly separated from its closest ally, *A. circumscriptus*, by the large globular spermatheca, and the extra long and almost uniform free-oviduct, a feature which distinguishes it also from the other species.

Description.—ANIMAL of somewhat cylindrical shape, but dorsally depressed, about thirty mill. long when fully extended, of an uniform bluish-grey or slate-grey colour, darkest and almost black mid-dorsally, shading paler towards the foot, with a black lateral band, which is most indistinct at its lower margin, and extends the whole length of the body and shield; BODY TUBERCLES comparatively broad, and forming about twenty-four longitudinal rows at each side; SHIELD comparatively small and coloured like the body, rounded in front and broadly rounded behind, finely shagreened, with the lateral banding of the body continued as a somewhat lyre-shaped black banding, which arches over the respiratory orifice; HEAD dark, especially in front; NECK pale; OMMATOPHORES dark, due in great part to the dusky retractors; SOLE not visibly tripartite, yellowish or orange; FOOT-FRINGE similarly coloured, with slight transverse furrows which are sometimes faintly pigmented.

DERMAL-MUCUS yellowish or orange coloured and very viscid, the caudal and locomotory mucus colourless, the latter stained by admixture with the yellow tegumentary slime.

The SHELL is described, especially by Italian authors, as well developed and solid, but in our British specimens it is usually soft and gelatinous, and only distinguishable by its colour, but hardens by exposure; occasionally, however, distinctly solid transparent stones may be found.

INTERNALLY, the BODY CAVITY is of a slaty-blue colour, except above the foot-sole, which shows an ochreous tint, minutely spotted with white; the SUPRA-PEDAL GLAND extends half the length of the body during repose, but during active movement it is only about one-third the total length of the whole body.

The CEPHALIC RETRACTORS are broader and flatter than in *Limax*, but of the usual *Arion* type. The TENTACULAR muscles spring from widely separated points, and the lower tentacular branch is strongly developed; the right tentacular muscle arises from the shield at the right margin of the kidney, while the left muscle springs from a corresponding point on the left margin, their roots being thus separated by the whole width of the kidney; the PHARYNGEAL retractor arises from the dorsal skin on or to the right of the median-line, quite behind the lung, about three mill. posterior to the tentacular muscles, and is cleft about mid-way, for attachment to opposite sides of the buccal bulb.

FIG. 222.—Cephalic retractors of *Arion hortensis* Fér., × 4.

The ALIMENTARY SYSTEM is, as in all its congeners, triodromous, although not exhibiting a very pronounced spiral torsion; the INGESTIVE TRACT extends posteriorly beyond the succeeding coils, and terminates in the true stomach; the ŒSOPHAGUS is fused to the PHARYNX from its origin up to the CEREBRAL GANGLIA; the CROP is voluminous, and pale brown in colour, with the whitish SALIVARY GLANDS attached to its sides; while the left lobe of the DIGESTIVE GLAND is, as is usual, directed backwards.

The REPRODUCTIVE ORGANS show a roundish or oval OVOTESTIS, with few acini, and is often of a dark colour, especially between the lobules, where it is frequently of a deep purplish-black; the DUCT is whitish or yellowish, long and slender, but becoming thicker and somewhat convolute as it approaches the gelatinous and greyish ALBUMEN GLAND; the OVIDUCT is sacculate and white, closely attached to the SPERM DUCT which on separation forms a short VAS DEFERENS; the FREE OVIDUCT is of great length and usually slender, except at the base, it is often, before distention, doubled upon itself in an S-like form; the EPIPHALLUS is short and conical, white basally, ringed above with dark grey, and merges almost

imperceptibly into the vas deferens, it secretes the short thick SPERMATOPHORE, which has a smooth, thin envelope, without the serrated crest so conspicuous in *Arion ater* and *A. subfuscus*; the SPERMATHECA is globular, variable in colour, and attached by its crown to the base of the OVISPERMATODUCT, the stem is short and thick; ATRIUM with a well-defined ochreous vestibular gland; the GENITAL RETRACTOR arises from the dorsum, behind the kidney, but soon bifurcates, the extremities becoming fixed to the stem of the spermatheca and the upper third of the free oviduct.

FIG. 223.

FIG. 224.

FIG. 225.

FIG. 223.—Reproductive organs of *Arion hortensis* Fér., × 2. (Christchurch, S. Hants).

FIG. 224.—Spermatophore of *Arion hortensis* Fér., Leipzic, greatly enlarged (from an original drawing by Dr. Simroth).

FIG. 225.—Alimentary canal of *Arion hortensis* Fér., × 2.

ot. ovotestis; *h.d.* hermaphrodite duct; *pr.* prostate; *v.d.* vas deferens; *ep.* epiphallus; *a.g.* albumen gland; *ov.* sacculated or glandular oviduct; *sp.* spermatheca; *vag.* vagina; *at.* atrium; *v.g.* vestibular gland; *r.m.* retractor muscles attached to spermatheca and free oviduct.

The MANDIBLE or jaw is about a mill. broad, and about half-a-mill. wide, with narrower but somewhat bluntly rounded ends, strongly arcuate from front to back, of an amber colour, with about ten vertical ribs or thickenings, apparently formed by overlappings of the substance of the jaw, which crenulate the upper margin and sometimes the lower margin also; the darker ribs and the clearer interstitial spaces show distinct vertical striæ; at about one-third of the width of the jaw, a dark line runs parallel with the cutting margin, showing the point of origin of the elasma, which extends on to the roof of the buccal cavity.

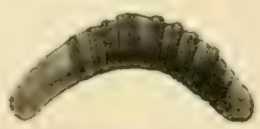


FIG. 226.—Mandible or jaw of *Arion hortensis*, × 20. (Christchurch, Hants S., Mr. C. Ashford).

The LINGUAL MEMBRANE is about three mill. long and one mill. wide, constituted by about 116 somewhat curved transverse rows of teeth, which diminish regularly in size to the margin of the membrane. The transverse rows are each composed of a strongly tricuspid median tooth, the strong yet somewhat slender mesocone, with distinct accessory lateral cutting expansions; the lateral teeth are about ten in number, obscurely tricuspid, but the endoconic cutting point is lost, the mesocone shewing the side expansions; the marginals are unicuspid, showing the powerful mesocone only, but towards the margin an ectoconic cutting point again becomes distinctly perceptible, while the few extreme marginals still retain their embryonic character.

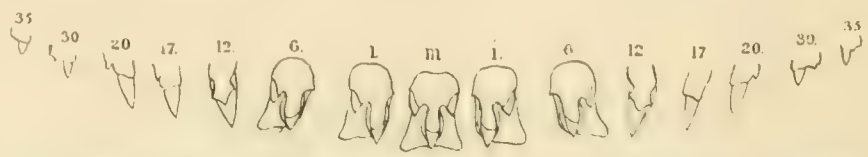


FIG. 227.—Representative denticles from a transverse row of the lingual teeth of *A. subfuscus*, × 180. The animal collected by Mr. C. Ashford, and the palate prepared by Mr. J. W. Neville.

The formula of a Christchurch specimen collected by Mr. C. Ashford is

$$7 + \frac{1\,9}{1+2} + \frac{1\,0}{2\cdot3} + \frac{1}{3} + \frac{1\,0}{2\cdot3} + \frac{1\,9}{1\cdot2} + 7 \times 116 = 8{,}468.$$

Reproduction and Development – The details of the congress of this species have never been recorded, but Mr. E. J. Lowe, who has frequently observed the act, describes it as very transitory, the actual congress, during which the spermatophores are exchanged, only occupying forty or forty-five seconds.

The eggs, which have been so frequently though erroneously described as phosphorescent for the first fifteen days after deposition, are subglobular in shape and a little over two mill. in length, semiopaque or quite translucent and of a milky-white colour, which, however, soon changes to a dull yellow.

They are deposited throughout the milder parts of the year, on the damp earth, or beneath stones or other shelter, to the number of seventy or more, agglutinated in several clusters by a yellowish mucus, and are said to hatch in from twenty to forty days, according to the weather, the young even in the earliest stages being said to show the same body markings as the adults, and to possess a distinct keel, which is, however, readily overlooked, as it is not distinguished by colour, and entirely disappears during growth, the animal becoming full-grown and adult towards the end of the first year.

Food and Habits.—*Arion hortensis* is essentially a garden species, and especially partial to heavy soils, though often found far from cultivated land, in fields, woods, and in damp places beneath logs and stones ; it is a rather active, but strictly geophilous species, seldom ascending any distance up the stems of trees or plants, though both young and adults can readily spin mucus threads to facilitate descent from elevated positions. It is a most destructive animal, hiding during the day beneath violets, strawberries, and other tufted plants, but coming out at dusk to feed, continuing its depredations throughout the night, and as it feeds quite at the base of the plants, its ravages are only discovered when too late ; it will burrow down to the bulbs of lilies, and feed upon them the winter through, it also eats off the bark from chrysanthemum stems, devours pansy branches, and the stems of earthed-up celery. In spring it will leave other food to feast upon the fallen petals of the apple and plum blossoms, and is if possible more destructive to strawberries than even *Agriolimax agrestis*.

According to Dr. Scharff, this species probably lives chiefly on decaying vegetation, as he has found it most numerous in gardens amongst heaps of old weeds.

In the potato-growing district around Selby, Yorkshire, *Arion hortensis* committed great ravages among the crops during the spring of 1904, by feeding upon and honeycombing the "potato-sets," and thus causing a very serious blight.

Mr. Gain found it a rather sickly species in confinement, and not so indiscriminate in its choice of food as might have been supposed, as out of 193 different kinds of foods offered to a colony of the typical form, ninety-one were totally rejected, and only twenty-five eaten freely, but not one with that avidity which is so characteristic when a really favourite food is offered. Dr. Scharff remarks that he has never found it on fungi, but in confinement Mr. Gain observes that it fed readily upon *Agaricus campestris*, *Russula emetica*, and several other species.

Like *Agriolimax agrestis* and *Milax sowerbii*, this species is, according to Mr. Reynell, strongly attracted by beer, and if this be placed in suitable shallow saucers in accessible positions on the ground, the animals will crawl into the liquid and drown.

Parasites and Enemies.—Probably almost equally liable with other species to destruction and annoyance by the ordinary enemies and parasites of slug-life ; there is, however, little published evidence on the subject, although it has been observed that the Blindworm (*Anguis fragilis*) which greedily devours *Agriolimax agrestis*, would not eat the present species, possibly on account of its very leathery skin and sticky mucus. A further protective feature was suggested by the late Mr. Sherriff Tye, who remarked upon the very remarkable likeness existing between this species and portions of the bloom-sheaths of the Black Poplar (*Populus nigra*), a protective resemblance which is operative at a period of the slug's greatest activity, and when its natural enemies, the thrushes, having young to provide for, are more industrious than usual in searching them out.

Fossil.—Kennard and Woodward record calcareous particles, believed to be the vestigial shells of this species, from a holocene deposit on the face of a chalk escarpment at Exedown, near Wrotham, in West Kent.

Variation.—The variation in this species runs in two chief lines, exemplified by the typical form and the large variety *subfuscus*.

Férussac has remarked on the circumstance that succeeding generations do not invariably reproduce the variation prevalent during the preceding year, and Dr. Scharff has observed the same peculiarity in the locality at Killakee in the Dublin Mountains, the large brown variety *subfusca* being exclusively found there in February, 1891, while in May of the previous year, in precisely the same spot all the specimens found were of the grey or typical form. In connection with this point, it may be remarked that Mr. Gain during his feeding experiments found a constant and marked difference as regards food in the likes and dislikes of the ordinary form and the var. *subfusca*.

Dr. Simroth is of opinion that the light-coloured variations are the effect of warmth, while the darker-hued individuals owe their shade of colouring to cold ; but this alone does not universally apply.

The grey variety is, however, found most prevalent in the open country, while the brown or yellowish variety are more numerous in other localities, though in gardens they may frequently be found in the closest association.

Fig. 228.

Fig. 229.

Fig. 228.—Proximal end of the Sexual system of *Arion hortensis*, enlarged (after Pollonera).

Fig. 229.—Proximal end of the Sexual system of *Arion cottianus*, enlarged (after Pollonera).

The *Arion cottianus* Poll. from Piedmont, and *Arion elongatus* Collinge from Somerset, do not seem to differ materially from the typical form of the present species.

Prof. Cockerell, in The Conchologist, 1891, p. 34, described an immature *Arion*, found at Acton, Middlesex, which he named var. *albipes*. It was described as a form of *Arion hortensis* with white foot and colourless slime.

Mr. B. Tomlin, in The Journal of Conchology, April 1887, records two albine specimens found at Hele, near Ilfracombe, in company with albine forms of other species, but he does not further allude to or describe them.

VARIATIONS IN COLOUR AND MARKINGS OF ANIMAL.

Var. **fasciata** Moquin-Tandon, Hist. Moll. France, 1855, p. 14.

Arion fuscus var. *fasciatus* Moquin-Tandon, op. cit.
Arion fuscus var. *pyrenaïcus* Moquin-Tandon, op. cit.
Arion fuscus var. *niger* Moquin-Tandon, op. cit.
Arion distinctus Mabille, Rev. et Mag. Zool., 1868, p. 137.
Arion elongatus Collinge, Ann. and Mag. Nat. Hist., 1894, p. 66, and pl. 5A.
Arion cottianus Pollonera, Arionidæ Europei, 1889, p. 14, ff. 23, 24.

ANIMAL grey, with darker dorsum, and a dark lateral band on each side. This form is usually regarded as typical of the species.

The var. **fasciata** s.str. is grey with darker dorsum and black lateral band.

The sub-var. **pyrenaica** is dark grey with blackish lateral band.

The sub-var. **nigra** is grey with black dorsum and lateral band. The grey is the true ground colour, but is almost entirely overspread by a greater development of the black pigment.

The sub-var. **distincta** is yellowish-grey, with blackish lateral band at each side, foot dull-yellow, not lineolated but speckled with yellowish.

The sub-var. **elongata** is yellowish-grey, the dorsal area and lateral band being black, sole and fringe yellow, the latter lineolate with sepia.

The sub-var. **cottiana** as figured is yellowish-grey with darker dorsum, and black lateral band.

ENGLAND.

Cornwall W.—Sub-var. *nigra*, Penmon near Falmouth, April 1884 ! H. Fox.

Somerset—Sub-var. *elongata*, on a lawn, Wainsgrove, E. W. Swanton (W. E. Collinge, op. cit.).

Hants. S.—Sub-var. *cottiana*, June 1891, E.W. Swanton (Collinge, Conchologist, Dec. 1892, p. 77).

Kent W.—Common in Dr. Gray's garden, Blackheath (Gray's Turton's Manual, 1840, p. 108). Near railway station, Chislehurst, Sept. 1884 ! T. D. A. Cockerell.

Notts.—Sub-var. *nigra*, not rare about Tuxford (Gain, Brit. Nat., Nov. 1893).

Lancashire S.—Sub-var. *nigra*, Hough Green near Widnes, March 1884 ! H. L. Edwards.

York N.E.—Thornaby (B. Hudson, Journ. of Conch., April 1886).

York S.W.—Lofthouse, April 1886 ! G. Roberts. Sub-var. *nigra*, Wakefield, 1886, J. Wilcock.

Durham—Durham, May 1887 ! H. E. Fox.

IRELAND.

Antrim—Sub-var. *nigra*, wood near Ballycastle, May 1897 (L. E. Adams, Irish Nat., July 1897).

Down—Cultra, Dec. 1891, R. F. Scharff.

Dublin—Killakee, Dublin Mountains, May 1890, R. F. Scharff.

Westmeath—Sub-var. *nigra*, the prevalent form at Clonmacnois, July 1895 (R. Standen, Irish Nat., Sept. 1895).

Tipperary S.—Var. *fasciata*, Clonmel, Dec. 1885, Rev. A. H. Delap.

CONTINENTAL DISTRIBUTION.

Germany—Sub-var. *distincta*, Neu Brisach, Alsace (Meyer, Nachr., Sept. 1876).

Belgium—Var. *fasciata*, Lokeren, East Flanders.

France—Var. *fasciata*, common at Crochère, Côte d'Or; sub-var. *pyrenaïca* is found above Luchon, Haute Garonne; sub-var. *nigra*, common at Bury, Oise; Amiens in the Somme; Pas de Calais; Haute Loire; and Paris, Seine; sub-var. *distincta*, under stones about Sevrès, department of the Seine.

Italy—Var. *fasciata*, Rivarossa, Canavese; and sub-var. *cottiana*, Bardonecchia, Valley of Dora Riparia, Piedmont.

Spain—Var. *fasciata* and sub-var. *nigra*, Galicia. Sub-var. *pyrenaïca*, near Monastery, Montserrat, Catalonia.

Var. **limbata** Moquin-Tandon, Hist. Moll. France, 1855, p. 14.

Arion fuscus var. *limbatus* Moquin-Tandon, op. cit.
Arion anthracius Bourguignat, Moll. nouv. lit., etc., 1866, p. 178, pl. 29, ff. 8-10.
Arion pelophilus Mabille, Ann. Malac., 1870, p. 117.

The var. **limbata** s.str. is black or blackish, foot-fringe orange or yellowish.

The sub-var. **anthracia** Bourguignat is uniformly black with paler foot-fringe.

The sub-var. **pelophila** Mabille is black with scarcely visible lateral bands, foot-fringe rufous.

CONTINENTAL DISTRIBUTION.

Belgium—Road-sides, Ixelles, Brussels (Colbeau, Mem. Soc. Mal. Belg., 1865, i., p. 47). Sub-var. *pelophila*, Belgium.

France—Var. *limbata* is reported by Baudon from gardens in the Oise; by Millet from Maine-et-Loire; by Pascal from the Haute Loire, and environs of Paris in the department Seine; and by Vaniot from the south of Amiens in the Somme; sub-var. *anthracia* from Eaux Bonnes in Basses Pyrénées; and sub-var. *pelophila* is recorded from the north of France and Arcueil in the environs of Paris.

Spain—Var. *limbata*, Galicia (Macho t. Hidalgo).

Var. **grisea** Moquin-Tandon, Hist. Moll. France, 1855, p. 14.

Arion fuscus var. *griseus* Moquin-Tandon, op. cit.
Arion fuscus var. *nemoralis* Dum. & Mort., Moll. Savoie, p. 8.

Animal pale grey, more or less unicolorous, and without lateral bands, foot-sole yellowish.

The sub-var. **nemoralis** is pale, the sides scarcely tinted, and the shield often palest towards the centre.

ENGLAND.

Wilts. N.—Abundant about Marlborough, E. Meyrick.

Kent W.—Chislehurst, Sept. 1884 ! T. D. A. Cockerell.

Middlesex—Among garden refuse, Bedford Park, Chiswick, Dec. 1884 ! T. D. A. Cockerell.

Norfolk E.—Heigham, May 1891 ! A. Mayfield.

Warwick—Ingon Grange, Stratford-on-Avon, Sept. 1884 ! R. J. Attye.

York N.E.—Battersby, Great Ayton, Dec. 1884 ! Baker Hudson. Thornaby (id., J. of Conch., April 1886, p. 48).

York S.W.—Campsall Woods, May 1886 ! W. Denison Roebuck. Penistone, July 1890 ! Lionel E. Adams.

IRELAND.

Antrim—A pale yellowish-grey sub-variety at Cushendun, May 1886 ! Rev. S. A. Brenan.

Louth—A pale form of var. *grisea*, Drogheda, Oct. 1904 ! P. H. Grierson.

Leitrim—A pale form of var. *grisea*, Mohill, July 1904 ! P. H. Grierson.

CONTINENTAL DISTRIBUTION.

Belgium—Common at Roumont, Luxemburg.

France—Recorded as common at Chatillon-sur-Seine, Côte d'Or; common in fields, etc., when not elevated, in the Ain; about Lyons in the Rhone; in the Pas de Calais; Maine et Loire; the Haute Loire and about Paris in the department of the Seine; sub-var. *nemoralis* in Savoy.

Spain—Galicia (Macho t. Hidalgo).

Var. **cœrulea** Collinge, Proc. Zool. Soc., 1897, p. 444, pl. 31, ff. 18, 19.

Limax fasciatus var. δ Nilsson, Moll. Sveciæ, 1822, p. 4.
Arion cæruleus Collinge, op. cit.

Animal described as blue or greyish-blue with dark-blue lateral bands, and pale yellow between the bands and the foot-fringe, sole white or pale-yellow, with red or yellowish slime, fringe white without lineoles.

This form was originally described as a variety, but was afterwards raised to specific rank by its author. It is perhaps the same as Nilsson's *Limax fasciatus* var δ.

ENGLAND.

Middlesex—Garden, Ealing, B. B. Woodward (Collinge, J. of Mal., Dec. 1895).

Berks—(W. E. Collinge, Conchologist, 1892, p. 26).

Oxford—Near Oxford, 1890 (W. E. Collinge, J. of Mal., Dec. 1895, p. 73).

Lancashire S.—Knowsley near Liverpool, 1893 (Collinge, J. of Mal., June 1893).

IRELAND.

Dublin—(W. E. Collinge, Conchologist, 1892, p. 26).

CONTINENTAL DISTRIBUTION.

Sweden—*L. fasciatus* var. δ, Lund (Nilsson, Hist. Moll. Sveciæ, 1822, p. 4).

Var. **lutea** Baudon, Mem. Limac. Oise, 1871, p. 6.

Arion hortensis var. *luteus* Baudon, op. cit.
Arion hortensis var. *aureus* Lessona, Arion. Piem., 1881, p. 10, f. 3.

Animal almost uniformly yellow, lateral bands faint.

The var. **lutea** s.str. is pale yellow, slightly tinged with greenish, greyish dorsally, with indistinct lateral banding.

The sub-var. **aurea** is yellow, pale on the flanks, the shield, caudal end of the body, the sole, and foot-fringe golden-yellow. Possibly this form is really referable to *Arion intermedius*.

ENGLAND.

Mid W. York—Pool Bridge, April 1887 ! W. K. Skipwith.

SCOTLAND.

Renfrew—A var. *flava* is recorded by Binnie for Lower Clydesdale, which may be this, or possibly intended to apply to *Arion intermedius*.

CONTINENTAL DISTRIBUTION.

France—Var. *lutea*, margins of woods, department of the Oise ; rather common in wood at Flagey, Côte d'Or.

Italy—Sub-var. *aurea*, Rivarossa Canavese, Piedmont.

Var. **virescens** Moquin-Tandon, Hist. Moll. France, 1855, p. 14.

Arion fuscus var. *virescens* Moquin-Tandon, op. cit.

ANIMAL greenish with black bands.

CONTINENTAL DISTRIBUTION.

France—Pas de Calais ; and Lyons in department of the Rhone.

Var. **subfusca** C. Pfeiffer, Deutsch. Moll., 1821, i., p. 20.

Limax subfuscus C. Pfeiffer, op. cit.
Arion fuscus var. *subfuscus* Moquin-Tandon, Hist. Moll. France, 1855, p. 14.
Arion hortensis var. *fallax* Cockerell, Garner, 1886, p. 139.

ANIMAL brownish, with a black band on each side.

The sub-var. **fallax** is described as grey, with black lateral band, but as so densely invested with orange slime as to appear of an orange-yellow. The author of the variety is now of opinion that it cannot be separated from the var. *subfusca*.

ENGLAND AND WALES.

Wilts S.—Garden, Steeple Ashton Vicarage, Mch. 1887 ! Rev. E. P. Knubley.

Hants. N.—Preston Candover, Oct. 1884 ! Rev. H. P. Fitzgerald.

Kent W.—St. Mary Cray, Sept. 1884 ! S. C. Cockerell.

Surrey—Haslemere, Aug. 1884 ! T. D. A. Cockerell. Sub-var. *fallax*, common on beech trees, Headley lane (T. D. A. Cockerell, Conchologist, Sept. 1891).

Essex S.—Woodford, May 1889 ! H. Wallis Kew.

Middlesex—Bedford Park, Chiswick, Dec. 1884 ! T. D. A. Cockerell.

Bedford—A hill west of Luton, Nov. 1886 ! J. Saunders.

Northampton—Yardley Chase, Oct. 1893, Lionel E. Adams.

Warwick—Ingon Grange, Stratford-on-Avon, Sept. 1884 ! R. J. Attye.

Stafford—Rowley Park, Stafford, May 1884 ! E. H. Wynne. Garden, Handsworth, June 1886 ! G. Sherriff Tye.

Glamorgan—Banks of river Ely, St. Fagan's, March 1885 ! F. W. Wotton.

Pembroke—Near Pembroke, June 1885 ! Mrs. Trayler.

Cardigan—Aberystwyth, May 1888 ! E. Collier. Miss Maddy's garden, Aberayron, June 1888 ! W. Whitwell.

Montgomery—Banks of Welshpool Reservoir ! also under timber in an open field by the river Severn, Jan. 1888 ! J. Bickerton Morgan.

Merioneth—Hills above Barmouth, Aug. 1884 ! John Hopkinson.

Lincoln N.—Sloothby, Aug. 1886 ! J. E. Mason. Well Vale, Sept. 1889 ! W. Denison Roebuck.

Notts.—Felley Abbey, Sept. 1884 ! common, Worksop ! Cleveland Hill, West Markham ! Pleasley Vale ! and Cresswell Crags, April 1884 ! C. T. Musson. Tuxford, April 1885 ! W. A. Gain.

Cheshire—Bollington, May 1885 ! J. G. Milne.

York S.E.—Millington village near Pocklington, April 1885 ! W. Denison Roebuck. Eccleshall, Oct. 1892 ! C. Oldham.

York N.E.—Wilton Wood, and Skelton Beck Valley, Saltburn, May 1887 ! W. Denison Roebuck.

York S.W.—Garden, Holmfirth, Jan. 1885 ! W. Denison Roebuck. Sub-var. *fallax*, Lofthouse, G. Roberts t. T. D. A. Cockerell.

York N.W.—Bowes and Greta Bridge, July 1884 ! W. Denison Roebuck.

Cheviotland—Under stones, Tweedmouth (Rev. J. McMurtrie, J. of Conch., July 1889).

SCOTLAND.

Edinburgh—Duddingston Loch, Edinburgh, Aug. 1886 ! W. Denison Roebuck. Dreghorn Woods near Colinton, Sept. 1889 ! W. Evans.

Stirling—Falls of Inversnaid, Aug. 1884 ! Baker Hudson.

Ebudes N.—Dunvegan, Isle of Skye, July 1890 ! W. Evans.

Ross W.—Gairloch, Nov. 1886 ! Rev. J. E. Somerville.

Sutherland E.—Golspie Burn, May 1885 ! W. Baillie.

Caithness—Dunbeath river, May 1884 ! W. Baillie.

IRELAND.

Antrim—Murlough, with type, May 1897, Lionel E. Adams.

Donegal—Carrablagh, Croaghross, Letterkenny, May 1889 ! H. C. Hart.

Dublin—Garden, Leeson Park, Dublin, Sept. 1890; and Killakee, Dublin Mountains, Feb. 1891, R. F. Scharff.

Sligo—Moyview, Ballina, April 1889 ! Miss Amy Warren.

Galway W.—Roundstone and Aran Island, Sept. 1891, R. F. Scharff. Kylemore Castle Gardens, Sept. 1904 ! W. Comfort.

Tipperary S.—Sub-var. *fallax*, Clonmel, Rev. A. H. Delap t. T. D. A. Cockerell.

CONTINENTAL DISTRIBUTION.

Germany—In beech woods on the road to Spickershausen, Cassel (C. Pfeiffer, op. cit.).

France—In the departments of Pas de Calais, Haute Loire, and Seine.

Spain—Galicia (Macho t. Hidalgo).

Var. **rufescens** Moquin-Tandon, Hist. Moll. France, 1855, p. 14.

ANIMAL reddish with black lateral bands.

ENGLAND AND WALES.

Middlesex—Bedford Park, Chiswick, Dec. 1884 ! T. D. A. Cockerell.

Oxford—Banbury and Bicester (W. E. Collinge, Conchologist, 1891, p. 13).

Worcester—Garden, Stourport, July 1888 (Williams, J. of Conch., July 1889).

Pembroke—Not uncommon about Tenby (Stubbs, J. of Conch., July 1900).

Cardigan—Aberystwyth (E. Collier, J. of Conch., Oct. 1888).

York N.E.—Near Middlesbrough (B. Hudson, J. of Conch., April 1886).

York N.W.—Ripon, May 1883 ! A. E. Ebdell.

SCOTLAND.

Caithness—Dunbeath river, May 1884 ! W. Baillie.

IRELAND.

Fermanagh—Castle Coole, Enniskillen, Sept. 1899, Hon. C. L. Corry.

Galway E.—Woodyard, Clonbrock, Sept. 1904, Hon. R. E. Dillon.

CONTINENTAL DISTRIBUTION.

Belgium—Trooz near Liége (Colbeau, Mem. Soc. Mal. Belg., 1865, p. 83).

France—Lyons (Pollonera, Arionidæ Rég. Paleárct., 1890, p. 20).

Spain—Galicia (Macho t. Hidalgo).

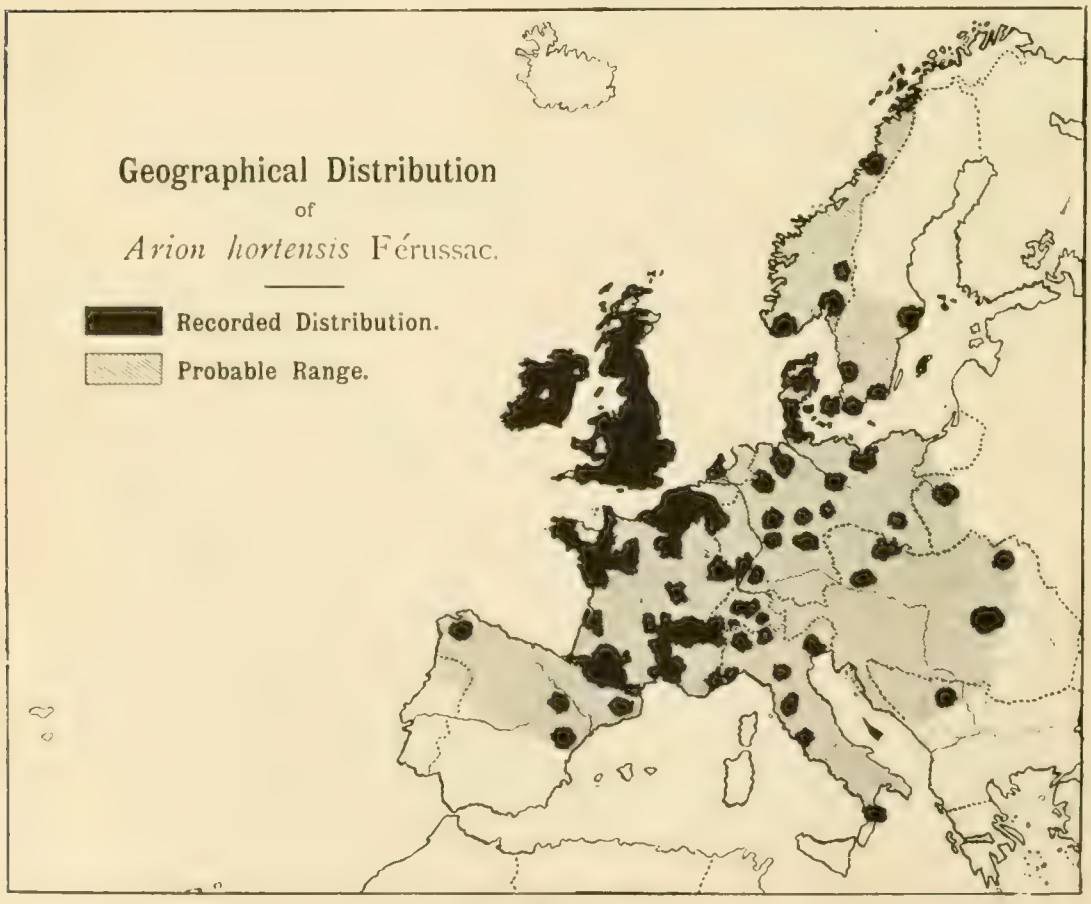


FIG. 230.

Geographical Distribution.—*A. hortensis* being the most advanced and most recently evolved species of its special section, has not yet attained a wide dispersal, being confined naturally to Central Europe, where it abounds more especially on cultivated lands. From its close association with cultivation it is liable to be transported to other regions, where its high and plastic organization almost ensure its dominancy.

It is found throughout the British Isles, chiefly congregating in gardens and on tilled ground, but is also found on wooded and waste lands far from cultivation.

The recorded continental distribution is not reliable, as this species has doubtless frequently been confounded with *Arion circumscriptus*, a closely-allied but more ancient and widely-dispersed species, from which it has only in recent years been authoritatively and satisfactorily distinguished.

ENGLAND AND WALES.

Channel Isles—Common under stones in Guernsey, Sark, and Herm (Cooke and Gwatkin, Quart. Journ. of Conch., 1878, p. 322). Enumerated for Jersey by Lukis (Ansted's Channel Isles, 1862). St. Sampson's, Guernsey, Sept. 1891 ! B. Tomlin.

PENINSULA.

Cornwall W.—Stenalee, St. Austell, Sept. 1904 ! C. P. Richards. Common in gardens, Truro, April 1886 ! and plentiful, Newquay, Sept. 1886, J. H. James. St. Ives, Sept. 1885 ! J. E. Mason. Sub-var. *nigra*, Penmon, Falmouth, April 1884 ! H. Fox.

Devon S.—Teignmouth, Oct. 1888 ! Loftus St. G. Byne. Garden, Topsham, and at Culverhole Point, Aug. 1892, Lionel E. Adams.

Devon N.—Northam, Nov. 1885 ! W. A. Gain. Abundant at Ilfracombe, Mch. 1887 (B. Tomlin, J. of Conch., April 1887). Belstone, Okehampton, Sept. 1904 ! Miss Daisy Mason.

Somerset S.—Near Porlock, Aug. 1892 ! Lionel E. Adams.

Somerset N.—Common in gardens, hedgebanks, and fields (Rev. A. M. Norman, Inland Moll. Somerset, 1860). Bath, June 1884 ! C. J. Waterfall. Sub-var. *elongata*, Wainsgrove, E. W. Swanton (W. E. Collinge, J. of Mal., June 1894).

CHANNEL.

Wilts. N.—Clyffe Pybard, Swindon, Aug. 1904 ! Rev. E. H. Goddard. Type and var. *grisea*, abundant about Marlborough, E. Meyrick.

Wilts. S.—Longleat gardens, Warminster, Sept. 1904 ! J. A. Singer. Type and var. *subfusca*, garden, Steeple Ashton Vicarage, March 1887 ! Rev. E. P. Knubley. Garden, Dunollie Bourne avenue, Salisbury, Sept. 1904 ! A. R. D. Bacchus.

Dorset—Purbeck and about Blandford, probably generally distributed (J. C. Mansel-Pleydell, Moll. Dorset, 1873, p. 110). Isle of Portland, Aug. 1892, L. E. Adams. Montevideo, Chickerell near Weymouth, Sep. 1904 ! Nelson M. Richardson.

Isle of Wight—Enumerated as found in a wood at Bembridge, and as common about Ventnor (Venables' Guide to Isle of Wight, 1860). Hempstead Hill near Yarmouth, 1880 ! Charles Ashford.

Hants. S.—Mudeford and Chuton, also common and very large in garden at Christchurch, Oct. 1884 ! C. Ashford. Portsdown Hill, May 1885 ! W. Jeffery. Roadsides, Binstead, A. Reynell. Sub-var. *cottiana*, Southampton, E. W. Swanton (W. E. Collinge, J. of Mal., Dec. 1892).

Hants. N.—Type and var. *subfusca*, Preston Candover, Oct. 1884 ! Rev. H. P. Fitzgerald.

Sussex W.—Too common in gardens and fields, Up Park, Aug. 1886 ! Cocking near Midhurst, Sept. 1886 ! and garden, Ratham, Nov. 1886 ! W. Jeffery.

Sussex E.—Common in the Ouse, Cuckmere and East Rother districts (J. H. A. Jenner, Eastbourne Nat. Hist. Soc. Report, 1880). Gardens, etc., everywhere common, Lewes, Blatchington, Eastbourne, Hastings, Battle, etc. (id., Sussex list, 1885, p. 6). Gardens, Queen's road, Brighton, Oct. 1903 ! F. G. S. Branwell. In chalk-pit on coast near Eastbourne, Sept. 1904 ! R. A. Adkin.

THAMES.

Kent E.—Folkestone, Oct. 1886 ! Charles Oldham. Ripple Vale near Dover, Sept. 1904 ! Mrs. G. Harrison.

Kent W.—Not so common as *Arion ater* about Sevenoaks (R. H. S. Smith, Zool., 1854, p. 4333). Dartford (H. C. Leslie, Q.J.C., 1874, p. 34). Hever, Edenbridge, Feb. 1898 ! A. Leicester. Type and var. *subfusca*, St. Mary Cray, Sept. 1884 ! S. C. Cockerell. Vars. *fasciata* and *grisea*, Chislehurst, Sept. 1884 ! T. D. A. Cockerell. Var. *fasciata*, garden, Blackheath (Gray's Turton's Manual, 1840, p. 108).

Surrey—Common, Reigate (Saunders, Reigate list, 1861). Cobham, Dr. Leach (Gray's Turton's Manual, 1840, p. 107). Croydon (K. McKean's Croydon list, 1883, p. 151). Near Warlingham, July 1883; amongst grass, by river-side, Kew, Dec. 1884 ! and garden, Syon Lodge, Isleworth, Feb. 1887 ! T. D. A. Cockerell. Holmfield, Wimbledon, July 1904 ! Miss Annie Rock. Common in garden, South Norwood and Wallington, A. Reynell. Addington and Tatsfield (C. Pannell, jr., J. of Conch., July 1903). Var. *subfusca*, Haslemere, Aug. 1884 ! T. D. A. Cockerell; and sub-var. *fallax*, Headley lane (id., Conchologist, Sept. 1891).

Essex S.—Var. *subfusca*, Woodford, May 1889 ! H. Wallis Kew.

Essex N.—Common everywhere (H. Laver, Colchester list, 1882). Manningtree, Sept. 1904 ! Rev. Proctor Benwell.

Herts.—Banks of river Gade, Cassiobury Park, Sept. 1883 ! garden, Watford, Oct. 1883 ! and St. Albans, July 1884 ! John Hopkinson. Ware, Sept. 1886 ! Charles Oldham. Hitchin, March 1886, Charles Ashford.

Middlesex—Common, Brentford, Nov. 1883 ! Mrs. Skilton. Bush Hill Park, May 1887 ! C. Ashford. Churchyard Bottom wood, Highgate, April 1889 ! and foot of garden walls, Hampstead lane, Dec. 1888 ! H. Wallis Kew. Hendon, Hampstead Heath, and Kensal Green, July 1883; Acton, Aug. 1884 ! type and vars. *subfusca*, *rufescens*, and *grisea*, Bedford Park, Chiswick, Dec. 1884 ! T. D. A. Cockerell. Var. *cærulea*, Ealing (W. E. Collinge, J. of Mal., Dec. 1895).

Berks.—Whytham Hill, March 1882 ! Rev. S. Spencer Pearce. Bradfield near Reading, Sept. 1904 ! Rev. E. Peake. Var. *cærulea* (Collinge, Conch., 1892, p. 73).

Oxford—Common throughout the county. Rare in woods, Watlington (Rev. A. M. Norman, Zool., 1853, p. 4127). Banbury (R. Stretch, Zool., 1855, p. 4541). Abundant in gardens, Combe near Woodstock, July 1904 ! Rev. S. Spencer Pearce. Var. *rufescens*, at Banbury and Bicester (Collinge, Conch., March 1891, p. 13). Var. *cærulea*, near Oxford, 1890 (id., J. of Mal., Dec. 1895).

Bucks.—Abundant, Chersley, Aug. 1883 ! Rev. H. H. Slater. Castlethorpe, May 1885 ! W. D. Crick. Abundant by road-sides, Olney churchyard, March 1893 ! Lionel E. Adams.

ANGLIA.

Suffolk E.—Common under logs, etc., in plantation, Blaxhall, May 1888 ! G. T. Rope. Lowestoft, Mendlesham ! Wickham Skeith, Brockford, and Needham Market (Mayfield, J. of Conch., April 1903). Common between Ipswich and Saxmundham, Aug. 1890, Lionel E. Adams.

Suffolk W.—Farnham St. Martin near Bury St. Edmunds, Oct. 1883 ! W. R. Burrell.

Norfolk E.—Whitlingham wood (J. B. Bridgman, Norfolk and Norwich Trans., 1872, p. 49). Norwich, Long Stratton, and Diss, Aug. 1890, Lionel E. Adams. Gardens, woods, and waste places under stones, logs, etc., Whitlingham, Yelverton, Framingham Earl, Earlham, and St. Faith's (Pearce and Mayfield, J. of Conch., July 1904). Gardens, Strumpshaw Hall, July 1904 ! W. J. O. Holmes. Type and var. *grisea*, Heigham, May 1891 ! A. Mayfield.

Norfolk W.—Thetford, Aug. 1890, L. E. Adams. King's Lynn, Sept. 1904 ! C. B. Plowright. Gardens, Didlington Hall, Sept. 1904 ! Hon. Mrs. Evelyn Cecil.

Cambridge—Grantchester, Sept. 1904 ! Hugh Watson.

Bedford—Limbury near Luton, Aug. 1904 ! Mrs. Blundell. General Cemetery, Luton, April 1889 ! also type and var. *subfusca*, hedgebanks, Luton, Nov. 1886 ! J. Saunders.

Huntingdon—Garden, Huntingdon, Sept. 1904 ! Miss E. M. Foster.

Northampton—Common about Peterborough and Fletton, Aug. 1883, A. W. Nicholls. Common in gardens and in woods, Northampton, Sept. 1884 ! W. D. Crick. Haselbeech, Sept. 1904 ! Rev. W. A. Shaw. Castle Ashby, April 1893 ! and var. *subfusca*, Yardley Chase, Oct. 1893, Lionel E. Adams.

SEVERN.

Gloucester E.—Very common in damp situations (Webster, Nat., 1854, p. 175). About Stroud, March 1884 ! E. J. Elliott. Common, Leckhampton, Aug. 1892 ! Lionel E. Adams.

Gloucester W.—Too common in gardens, Bristol (E. C. Jellie, Nat., Feb. 1867). Stroud, Oct. 1883 ! and numerous in the Forest of Dean, March 1884 ! E. J. Elliott.

Monmouth—Wyedale near Tintern, July 1883, C. T. Musson. Gardens, Shirenewton Hall, near Chepstow, June 1886 ! E. J. Lowe.

Hereford—Whitney-on-the-Wye, July 1883, C. T. Musson. Garden, Bishopswood Vicarage, April 1885 ! Rev. R. W. J. Smart. Kington, Nov. 1903 ! L. McKaig. Garden, Acacia Villa, Ross, Sept. 1904 ! W. Blake. Common in garden, Broomy Hill, Hereford, Sept. 1904 ! Miss M. A. Boycott.

Worcester—Hay Mills near Birmingham, 1868 ! W. Nelson. Not uncommon at Malvern (Griffiths' Malvern list, 1870, p. 158). Selly Oak, Feb. 1892, L. E. Adams. Type and var. *rufescens*, Stourport, July 1888 (Williams, J. of Conch., July 1889).

Warwick—Solihull, Feb. 1893, Lionel E. Adams. Sutton Coldfield, 1897, Albert Wood. Garden, Bradford street, Birmingham, Sep. 1904 ! J. Madison. Vars. *grisea* and *subfusca*, Ingon Grange, Stratford-on-Avon, Sept. 1884 ! R. J. Attye.

Stafford—Common (Garner's Nat. Hist. Staffs., 1844, p. 301). Common about Stafford, June 1885, and near the castle, Sept. 1885, Lionel E. Adams. Plentiful in garden, Cheadle, Apr. 1886 ! F. B. Webb. Cauldon, Aug. 1888 ! J. R. B. Masefield. Common in gardens, Hamstead (G. Sherriff Tye, Q. J. of Conch., May 1875, p. 68). Type and var. *subfusca*, common in garden, Handsworth, April 1886 ! id. Type and var. *subfusca*, Rowley Park, Stafford, May 1884 ! E. H. Wynne.

Salop—St. Oswald's Well, Oswestry, June 1885 ! Baker Hudson.

SOUTH WALES.

Glamorgan—Common about Swansea, H. Rowland Wakefield. Cardiff, Oct. 1885 ! and var. *subfusca*, St. Fagan's, March 1885 ! F. W. Wotton.

Radnor—Bont House, Penybont, Nov. 1903 ! F. Hall. Erwood, Aug. 1904 ! J. Williams Vaughan.

Carmarthen—Llanelly, Sept. 1904 ! and Kidwelly, Dec. 1903, Rev. Ll. Davies. Golden Grove, Sept. 1904 ! Lady Lyons.

Pembroke—Haverfordwest, Sept. 1904 ! Price Davies. Type and var. *subfusca*, Pembroke, June 1885 ! Mrs. Trayler. Type, abundant, North Cliff, Tenby ; var. *rufescens*, not uncommon, A. G. Stubbs.

Cardigan—Type and vars. *subfusca* and *rufescens*, Aberystwyth, May 1888 ! E. Collier. Type and var. *subfusca*, garden, Aberayron, June 1888 ! W. Whitwell.

NORTH WALES.

Montgomery—Powell's Ford, Welshpool (J. Bickerton Morgan, Montgom. list, 1888, p. 232). Var. *subfusca*, banks of Welshpool Reservoir ! also under timber in an open field by the river Severn, Jan. 1888 ! J. Bickerton Morgan.

Merioneth—Nant-y-Mor, June 1901 ! W. Denison Roebuck. Type and var. *subfusca*, hills above Barmouth, Aug. 1884 ! J. Hopkinson.

Carnarvon—Beddgelert ! Dinas ! and Conway Castle, July 1883 ! W. D. Roebuck.

Denbigh—Gloddaeth Woods ! Llandrillo yn Rhos ! and Bodscallan Woods, July 1883 ! W. Denison Roebuck.

Flint—Mostyn Marsh, July 1883 ! W. Denison Roebuck. Grange road, Rhyl, July 1904 ! Rev. A. Steele Perkins.

Anglesey—Common on the island, Aug. 1883 ! J. Hopkinson.

TRENT.

Lincoln S.—Ermine street near Ancaster, April 1886 ! and Frampton Fen near Boston, Sept. 1889 ! W. Denison Roebuck. Old quarry, Great Ponton, Aug. 1902 ! R. Worsdale. Careby Wood, June 1903 ! H. W. Kirkby.

Lincoln N.—Tothill, May 1888 ! Miss Susan Allott. Redbourn, Feb. 1903 ! and Claxby, April 1903 ! Rev. E. A. Woodruffe-Peacock. Haugham Wood ! Burwell Wood ! Ailby, April 1886 ! and Navenby, Dec. 1901 ! W. Denison Roebuck. Bilsby near Alford, May 1886 ! Greenfield Wood, June 1887 ! and Ulceby-with-Fordington, Oct. 1889 ! also type and var. *subfusca*, Sloothby, Aug. 1886 ! J. E. Mason. Type and var. *subfusca*, Well Vale near Alford, Sept. 1889 ! W. Denison Roebuck.

Leicester and Rutland—Very common in gardens in Leicester and Aylestone (H. E. Quilter, Moll. Leic., 1888, p. 8). Groby, May 1885 ! H. E. Quilter.

Notts.—Common, Beeston, and Highfield House, Nottingham, E. J. Lowe. Castle Rock, Nottingham, Sept. 1884 ! Annesley churchyard, Sept. 1884 ! Newark, Oct. 1884 ! Houghton, April 1885 ! and Colwell, Aug. 1885 ! C. T. Musson. Felley Abbey, June 1888 ! Hunger Hill and Corporation Gardens, Nottingham, June 1888 ! G. W. Mellors. Southwell, Sept. 1892 ! C. Oldham. Type and vars. *fasciata*, *subfusca*, and sub-var. *nigra*, Tuxford, April 1885 ! W. A. Gain. Var. *subfusca*, Felley Abbey, Sept. 1884 ! Worksop ! Cleveland Hill, West Markham ! Pleasley Vale ! and Cresswell Crags, April 1884 ! C. T. Musson.

Derby—Common in the county (H. Milnes, Midl. Nat , May 1882). Markland Grip, April 1884 ! C. T. Musson. Miller's Dale and Monsal Dale, Aug. 1885 ! C. Oldham. Common about Hathersage, Ashbourne, Bakewell, and Clifton, Aug. 1889 ! Lionel E. Adams.

MERSEY.

Cheshire—Garden, Sale, May 1884 ! and Baguley Hall, Sept. 1892 ! C. Oldham. Garden, Liverpool road, Chester, Oct. 1887 ! Brockton Tomlin. Marple, May 1891 ! L. St. G. Byne. Gardens about Upton (Higgins, Liverpool list, 1891, p. 23). Garden, Oxton, Birkenhead, July 1904 ! Ashley, Hale, and Ringway near Bowdon, Dec. 1884 ! and Mere Park near Knutsford, Oct. 1885 ! also type and var. *subfusca*, Bollington, May 1885 ! J. G. Milne.

Lancashire S.—Gardens, Didsbury, Chorlton-cum-Hardy, etc. (J. Hardy, Manchester list, 1865, p. 34). Frequent and of large size in gardens at Greenheys, R. D. Darbishire, 1885. Common under stones, Manchester, 1880, Lionel E. Adams. Between Liverpool and Warrington, Sept. 1885, T. D. A. Cockerell. Whalley, Aug. 1885 ! W. Denison Roebuck. Farington, Oct. 1889 ! W. H. Heathcote. Garden, Glen Esk, Whalley Range, Oct. 1904, R. Welch. Var. *cærulea*, Knowsley (W. E. Collinge, J. of Mal., March 1893). Type and sub-var. *nigra*, Hough Green near Widnes, March 1884 ! H. L. Edwards.

Lancashire Mid—Abundant at Fulwood, Feb. 1889 ! and in garden, Frenchwood street, Preston, June 1890 ! W. H. Heathcote. Common at Fleetwood, Sept. 1891, Lionel E. Adams.

HUMBER.

York S.E.—Kilnsea, March 1884 ! W. Eagle Clarke. All along the coast from Hull northwards, Sept. 1891, L. E. Adams. Malton. Sept. 1880 ; abundant, Beverley, Kildwick Percy, and on canal banks, Driffield, J. D. Butterell. Common at Hornsea (id., J. of Conch., 1881, p. 136). Sledmere, Aug. 1891 ! F. W. Fierke. Brough, May 1901 ! J. E. Crowther. North Grimston and Drewton, T. Petch. Speeton, May 1883 ! Filey, Danes Dyke, and Flamborough, May 1886 ! also var. *subfusca*, Millington near Pocklington, April 1885 ! W. Denison Roebuck. Var. *subfusca*, Eccleshall, Oct. 1892 ! C. Oldham.

York N.E.—In Swaledale it has been recorded as living on moist hedgebanks, Grizzlefield, and in the Holmes, Thirsk (J. H. Davies, Nat., 1855, p. 134). Common about Pilmoor Junction, Oct. 1882 ! W. Denison Roebuck. Garden, Pickhill Vicarage, April 1888 ! Rev. E. P. Knubley.

In Vale of Derwent : Scarborough, C. Ashford. Lowdales near Hackness, July 1882 ! Farwath Bridge, Newtondale, Aug. 1886 ! Helmsley, July 1884 ! Beedale, June 1901 ! and Harwoodale, May 1904 ! W. Denison Roebuck. Abundant under logs about York, R. M. Christy.

In Teesdale : Redcar (C. Ashford, J. of Conch., Jan. 1882). Wilton Wood, July 1884 ! Baker Hudson. Gardens, Middlesbrough, Sept. 1886 ! W. A. Lofthouse. Tockett's Wood, Guisbrough, May 1897 ! Green lane, Marske, April 1889 ! W. D. Roebuck. Vicarage garden, Ingleby Greenhow. Sept. 1890 ! Rev. J. Hawell. Var. *rufescens*, Middlesbrough, var. *fasciata*, Thornaby, and var *grisea*, Battersby, Great Ayton, and Thornaby, Dec. 1884 ! (B. Hudson, J. of Conch., April 1886). Type and var. *subfusca*, Wilton Wood, and Skelton Beck Valley, Saltburn, May 1887 ! W. Denison Roebuck.

York S.W.—In Calderdale: Abundant about Stanley and Wakefield, Jan. 1885 ! J. Wilcock. Common, Birkenshaw, J. Emmet, 1884. Not uncommon in Huddersfield gardens (G. H. Parke in Hobkirk's Huddersfield, 1868. p. 224). Gardens, Holmfirth, Jan. 1885 ! H. E. Craven. Bottoms, Heckmondwike, March 1903 ! T. Castle. Hebden Bridge, June 1904 ! W. Denison Roebuck. Near Sowerby Bridge (J. E. Crowther, Halifax Nat., Aug. 1903). Sub-var. *nigra*, Wakefield, 1886, J. Wilcock. Var. *subfusca*, Holmfirth, Jan. 1885 ! W. Denison Roebuck.

In Airedale : Common about Bradford, T. Rhodes. 1903. Seven Arches, Bingley, Feb. 1884 ; Saltaire, Nov. 1886 ! and Gilstead, H. T. Soppitt. Common, Bramley Fall Wood, Oct. 1882 ! and by the canal, Calverley, Feb. 1882 ! W. Nelson. Canal bank, Shipley, and Frizinghall, July 1882 ! W. Denison Roebuck. Abundant about Armley, Apl. 1890 ! L. E. Adams. Type, var. *fasciata*, and sub-var. *fallax*, garden, Lofthouse, April 1886, G. Roberts.

In the Don valley : Not uncommon about Ackworth (C. Ashford, Q. J. of Conch., 1874, p. 20). Wragby, March 1882 ! W. Nelson. Carlton Park and Snaith, June 1882 ! Cantley Park Woods ! Kilham ! Blaxton Grange, May 1883 ! abundant, Roche Abbey Woods, April 1884 ! and Burghwallis, also type and var. *grisea*, Campsall Woods, May 1886 ! W. Denison Roebuck. Doncaster and Conisborough, July 1891, also var. *grisea*, Penistone, July 1890 ! Lionel E Adams.

York Mid W.—In Wharfedale, it has been found at Grassington, June 1882 ! Common, Bolton Bridge and Barden Tower. April 1883 ! Common on banks of the reservoir at Fewston, March 1882 ! and abundant at Oughtershaw, Aug. 1882 ! W. Denison Roebuck. Common in Buckden Wood, Buckden Gill, and Buckden Village ; also Cray Gill, Aug. 1904 ! Tom Petch. Var. *lutea*, Pool Bridge, April 1887 ! W. K. Skipwith.

In Nidderdale, it is very common in gardens, Birstwith (Walker, J. of Conch., Jan 1882). Killinghall, July 1882 ! W. Nelson. Common about Pateley Bridge, May 1882 ! W. Storey. Generally distributed and especially numerous in cultivated places, Harrogate, Ripley, Weeton, Pannal, Rudding, Ribston, Knaresborough and Hampsthwaite, as well as in Copgrove Woods (Fitzgerald, J. of C., Jan. 1889).

In Wensleydale, it is common at Eavestone near Ripon, Feb. 1883 ! J. Ingleby.

In Ribblesdale, at Lawley Abbey and Bashall Moor Wood, also Whitewell and Dunsop in Bowland, Aug. 1885 ! W. Denison Roebuck. Clapham, H. Richardson, J. of Conch., 1886, p. 60.

In Airedale, it is common at Scarcroft ! W. Nelson. Roundhay Park, Sep. 1884 ! W. Denison Roebuck. Rawdon Wood Bottom, Feb. 1904, W. Harrison Hutton. Gardens in the outskirts of the city of Leeds, May 1885 ! T. W. Bell.

York N.W.—In Teesdale, it has been found at Rokeby, June 1892 ! W. Nelson. Type and var. *subfusca*, Bowes and Greta Bridge, Aug. 1903 ! W. Denison Roebuck.

In Swaledale, at Angram, Satron, and Gunnerside Gill, July 1884 ! also roadsides near Brafferton Spring Wood. Sept. 1882 ! W. Denison Roebuck.

In Wensleydale, at Hackfall, 1868 ! Marsett, Semerdale, Aug. 1882 ! summit of Counterside, July 1884 ! and at an altitude of 1,400 feet on the slopes of Askrigg Common, July 1884 ! W. Denison Roebuck. Masham, Aug. 1901, C. Crossland. Var. *rufescens*, Ripon, May 1883 ! A. E. Ebdell.

TYNE.

Durham—Spa Wood, Dinsdale, May 1887 ! B. Hudson. Var. *fasciata*, Durham, May 1887 ! H. E. Fox.

Northumberland—Common at Gosforth, June 1904 ! Mrs. Willans.

Cheviotland—*Limax fuscus* in dean above Akeld (G. Johnston, Proc. Berwick Nat. Club, 1852, p. 89). Type and var. *subfusca*, Tweedmouth, Dec. 1888 ! Rev. J. McMurtrie.

LAKES.

Westmorland and Lake Lancashire—Kendal, 1853, E. J. Lowe. Abundant in gardens, Coniston, Oct. 1886 ! W. Denison Roebuck. Under stones, Windermere road, Grange, July 1903 (Jackson and Moore, Journ. of Conch , July 1904, p. 45).

Cumberland—Common at Stanwix and Blaithwaite (Miss Donald, Cumberland list, 1882). Haverigg, 1883, C. T. Musson. Brigham, Cockermouth, July 1894 ! Mrs. Robinson.

Isle of Man—Common on the island, Lionel E. Adams. About Douglas, Sept. 1892 ! F. Taylor.

SCOTLAND. *WEST LOWLANDS.*

Dumfries—Dumfries, Sept. 1890 ! and Moffat, Jan. 1891 ! W. Evans.

Kirkcudbright—Maxwelltown, Sept. 1890 ! W. Evans.

Wigtown—Springbank near Stranraer, Sept. 1890 ! W. Evans.

Ayr—Girvan, Sept. 1890 ! W. Evans. Common, Seamill, West Kilbride ; and Largs, March 1904 ; also common along cliff-foot, Portincross, Rev. R. Godfrey.

Renfrew—Frequent, Shielhill Glen, Kilmalcolm, etc. (Scott, Greenock list, 1886). In oat-field, Shielhill Glen, Aug. 1886 ! W. Denison Roebuck. Var. *flava*, common as type in Lower Clydesdale (F. G. Binnie, West Scot. list, 1876, p. 41).

Lanark—Possil Marsh, Aug. 1886 ! W. Denison Roebuck. Blackwood estate, Kirkmuirhill, Sept. 1904 ! N. B. Kinnear.

EAST LOWLANDS.

Peebles—Roadside, Earlyburn, alt. 800 feet, July 1889 ! W. Denison Roebuck. West Linton and near Peebles, July 1890 ! W. Evans.

Selkirk—Railway-yard, Thornielee, Aug. 1886 ! W. Denison Roebuck. Common at Selkirk, Oct. 1890 ! W. Evans.

Roxburgh—Jedburgh and Langlee near Galashiels, Sept. 1904 ! J. Roseburgh.

Berwick—Common, Cockburnspath, Berwick ! Eyemouth, etc. (W. Evans, Proc. Berwick Nat. Club, 1895, p. 171). Kirklands, Earlston, Aug. 1886 ! W. D. Roebuck.

Haddington—Falside, and on abandoned railway, Drummore, Aug. 1886 ! W. D. Roebuck. Common near Berwick (Rev. J. McMurtrie, J. of Conch., Jan. 1889). Dunbar and Longniddry, Sept. 1901 ! W. Evans.

Edinburgh—Hillend, at the foot of Pentlands, Feb. 1896 ! Penicuik, Oct. 1896 ! Crichton, Feb. 1897 ! etc., W. Evans. Foot of Salisbury Craigs, Aug. 1886 ! and Blackford Hill, Oct. 1888 ! also type and var. *subfusca*, near Duddingston Loch, Aug. 1886 ! W. Denison Roebuck. Var. *subfusca*, Dreghorn Woods near Colinton, Sept. 1889 ! W. Evans.

Linlithgow—Linlithgow, March 1890 ! and Philipstown, April 1901, W. Evans. Abundant in the county : Dalmeny, Hopetown and Carriden on the coast ; Graeme's Dyke, Red Hill, Northbank, Kinneil Woods, quarry near Craigwailen Church in the Bo'ness district ; Jinkaboot, Kinneil Mill, and Linlithgow Bridge in the Avon valley ; and at Cramond Bridge, Rev. R. Godfrey. South Queensferry, Aug. 1886 ! W. Denison Roebuck.

EAST HIGHLANDS.

Fife and Kinross—North Queensferry, Aug. 1886 ! W. Denison Roebuck. Dura Den and St. Andrew's, July 1890 ! also Crail, Aug. 1890 ! W. Evans. Abundant in Charlestown lime quarries, and Burntisland, Feb. 1896, W. Evans.

Stirling—Polmont, Aug. 1890 ! W. Evans. Type and var. *subfusca*, Falls of Inversnaid, Aug. 1884 ! B. Hudson.

Perth S. and Clackmannan—Callander, April 1892 ! Dollar, April 1897 ! Abbey Craig, Oct. 1901, W. Evans. Balquhidder, July 1904 ! Rev. R. Godfrey.

Perth Mid—Glen Tilt, May 1885 ! H. Coates. Glen Ogle, July 1904 ! Rev. R. Godfrey. Dunkeld road, Perth, Sept. 1904 ! W. Evans. Inver, Dunkeld, Sept. 1904 ! A. Rodgers.

Perth N.—Persie Inn, Glenshee, July 1890 ! W. Evans.

Forfar—Dundee, July 1890 ! W. Evans.

Kincardine—Along the coast, south of Stonehaven, Sept. 1886, W. Evans.

Aberdeen S.—Wood near Old Bridge of Don, in tufts of *Aira cæspitosa*, Sept. 1848 (Macgillivray, Deeside and Braemar list, 1855, p. 418). Garden, Rubislaw, Aberdeen, Oct. 1904 ! G. Sim.

Banff—Tomintoul, Sept. 1891 ! W. Evans. Macduff, Dec. 1890 ! A. Robertson.

Easterness—Nairn, Jan. 1887 ! Rev. J. E. Somerville. Glen Feshie, alt. 1,250 ft., Sept. 1889 ! and Dalwhinnie, alt. 1,200 ft., June 1892 ! W. Evans. Garden, Coylum Bridge, Aviemore, Aug. 1904 ! Rev. R. Godfrey.

WEST HIGHLANDS.

Westerness—Glenborrodale, Dec. 1890 ! J. J. Dagleish.

Main Argyle—Hunter's Quay, Aug. 1886 ! W. Denison Roebuck. Crinan, Oct. 1886 ! Rev. J. E. Somerville.

Dumbarton—High Mains, Aug. 1886 ! W. Denison Roebuck. Duntocher, Sept. 1888 ! and Garscadden, June 1889 ! A. Shaw.

Clyde Isles—Barone and Ardbeg Point, Isle of Bute, Aug. 1886 ! W. Denison Roebuck. Brodick, Isle of Arran, April 1895 ! W. Evans.

Cantire—Ardrishaig, Sept. 1904 ! Rev. R. Godfrey.

Ebudes N.—Type and var. *subfusca*, Dunvegan, July 1890 ! W. Evans.

NORTH HIGHLANDS.

Ross W.—Ullapool, Aug. 1886 ! Alex. Somerville. Coast of Loch Broom, Oct. 1886 ! and var. *subfusca*, Gairloch, Nov. 1886 ! Rev. J. E. Somerville.

Sutherland E.—Var. *subfusca*, Golspie Burn, May 1885 ! W. Baillie.

Sutherland W.—Stoer, Oct. 1886 ! Rev. J. E. Somerville.

Caithness—Wick: a pest especially in gardens (C. W. Peach, Roy. Phys. Soc. Edinb., 1864). Type and vars. *subfusca* and *rufescens*, Dunbeath river, May 1884 ! W. Baillie.

NORTH ISLES.

Hebrides—Stornaway, Isle of Lewis, Aug. 1886 ! Alex. Somerville.

Orkneys—Harray, Dec. 1890 ! W. Evans. Seafield House, Stromness, Sept. 1904 ! J. Grant.

IRELAND.

ULSTER.

Derry—Very common about Coleraine, Nov. 1883 ! Lionel E. Adams. Bellarena Flats, March 1904 ! R. Welch. Ballynagard, June 1892 ! and Gortness, Sept. 1904 ! D. C Campbell. Straidarran, July 1904 ! P. H. Grierson. Garden, Downhill, Sept. 1904 ! C. W. Lynes.

Antrim—Common throughout Antrim, R. Welch. Whitehall, Broughshane, June 1886 ! Rev. S. A. Brenan. Rathlin Island and common at Murlough, May 1897, L. E. Adams. Cave Hill, 1893; Knockagh Mountain, 1897; Derrykeighan Derrock, 1898; Magheramorne, 1898; Colin Glen, Nov. 1899; Ram's Island, May 1900; Kenbane Head and Glenshesk, May 1902, R. Welch. Glenavy, May 1900, H. L. Orr and R. Welch. Ballycastle, Oct. 1904 ! Miss F. S. O'Connor. The Manse, Antrim, Sept. 1904 ! U. S. Smith. Var. *nigra*, wood near Ballycastle and var. *subfusca*, Murlough, May 1897 (Adams, Irish Nat., July 1897). Type and yellowish form of var. *grisea*, Cushendun, May 1886 ! Rev. S. A. Brenan.

Down—Common at Cranmore, Belfast (Templeton, Ann. Nat. Hist., 1840, p. 18). Orlock Point, Dec. 1896, Capt. Farrar and R. Welch. Belvoir Park, June 1894, and Oakleigh, Ormeau Park, Belfast, May 1898, A. W. Stelfox. Downpatrick near Sampson's Stone, April 1900; St. John's Point, 1897; Ballynoe, Jan. 1898; Ardglass Castle, Dec. 1897; Belmont Nursery, April 1898; Newcastle, June 1898; Hillsborough Park, 1902; Crawfordsburn, 1902; and rare at Lough Aghery, May 1904, R. Welch. Killard Point, 1898 ! and Helen's Bay Golf Links, Sept. 1904, A. W. Stelfox and R. Welch. Var. *fasciata*, Cultra, Dec. 1891, R. F. Scharff.

Armagh—Bessbrook, April 1900, R. Welch. Acton Glebe, Poyntz Pass, Sept. 1904 ! Rev. W. F. Johnson. Portadown, Oct. 1904 ! W. A. Green.

Monaghan—Glaslough, Nov. 1897; and Clones Round Tower, 1901, R. Welch. Carrickmacross, July 1904 ! Drumreaske, Sept. 1904 ! W. F. de Vismes Kane.

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Respects Compl

MONOGRAPH
OF THE
LAND & FRESHWATER MOLLUSCA
OF THE
BRITISH ISLES.

JOHN W. TAYLOR.

195451

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ublished June 15, 1906.

MONOGRAPH
OF THE
LAND AND FRESHWATER MOLLUSCA
OF THE
BRITISH ISLES.

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AS it is very desirable that the Mandible and Odontophore of all the various native Gastropods should be figured in the work, the author would be grateful for adult living examples of almost any of the species for that purpose.

It is further desired to obtain the loan of **Portraits** or **Autographs** of any of the eminent Conchologists or Palæontologists. Amongst others, it is especially desirable to obtain Portraits and Autographs of Colonel Montagu, Captain Brown, the Rev. Revett Sheppard, Prof. Macgillivray, Dr. Leach, Prof. Sandberger, Mr. Searles Wood, Mr. F. Edwards, etc., etc.

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Any help calculated to enhance the interest or render the Monograph more complete will be gratefully appreciated and fully acknowledged by the author—

JNO. W. TAYLOR,
NORTH GRANGE, HORSFORTH, LEEDS.

Tyrone—Omagh, July 1904 ! P. H. Grierson. Baronscourt, Sept. 1904 ! R. Bell.
Donegal—Bundoran, Aug. 1889 ! J. G. Milne. Ardara, April 1900 ; and Mevagh Rosguill, Oct. 1903, R. Welch. Templemore Park, Sept. 1904 ! D. C. Campbell. Var. *subfusca*, Carrablagh, Croaghross, Letterkenny, May 1889 ! H. C. Hart.
Fermanagh—Killyhevelin, Sept. 1899, R. Welch. Brookeborough, Sept. 1904 ! Sir Douglas Brooke. Enniskillen, Sept. 1904 ! Dean of Clogher. Type and var. *rufescens*, Castlecoole, Enniskillen, Sept. 1904 ! Hon. C. L. Corry.
Cavan—Mullagh, July 1904 ! P. H. Grierson.

LEINSTER.

Louth—Blackhall Demesne, Sept. 1904 ; Narrow Water, Dec. 1904 ! also type and a pale form of the var. *grisea*, Beaulieu, Drogheda, Oct. 1904 ! P. H. Grierson.
Meath—Navan, July 1900, R. Welch. Drumcondra, July 1904 ! P. H. Grierson.
Dublin—Damp gardens in Monkstown (W. W. Walpole, Zool., 1853, p. 4022). Dublin, March 1886 ! J. R. Redding. Banks of river Dodder, Rathmines, April 1887 ! R. F. Scharff. Common in gardens, Rathgar, Sept. 1903 ; and almost everywhere in Bushy Park, Dublin, Sept. 1903 (Welch and Stelfox, Irish Nat., June 1904). Type and var. *subfusca*, Killakee, Dublin Mountains, Oct. 1890 ; garden, Leeson Park, Dublin, Sept. 1890 ; and Kilruddery Demesne, Sept. 1890, R. F. Scharff.
Kildare—Lyns, Aug. 1904 ! P. H. Grierson. Naas, Oct. 1904 ! R. J. P. Beresford.
Wicklow—Maynooth, Nov. 1891, R. F. Scharff ; Woodenbridge, March 1893 (id., Irish Nat., April 1893). Enniskerry, Aug. 1904 ! P. H. Grierson. Bray, Sept. 1904 ! R. M. Barrington.
Wexford—Wexford, April 1891, R. F. Scharff.
Carlow—Fenagh House, Bagenalstown, Sept. 1904 ! Denis R. Pack-Beresford.
Kilkenny—Kilkenny, Sept. 1904 ! J. White. Gardens, Kilkenny Castle, Sept. 1904 ! J. Carlton. Gardens, Bessborough, Piltown, Sept. 1904 ! Earl of Bessborough.
Queen's Co.—By no means scarce at La Bergerie (B. J. Clarke, Ann. Nat. Hist., 1840, p. 198). Stradbally, Sept. 1904 ! A. G. Stuart.
King's Co.—Clonmacnois, July 1895, the var. *nigra* being the prevalent form (R. Standen, Irish Nat., Sept. 1895). Birr, Sept. 1904 ! Miss Hemphill. The Gardens, Charleville Forest, Tullamore, Sept. 1904 ! Rev. R. McKenna.
Westmeath—Rosemount, Moate, Sep. 1904 ! Mrs. Nugent. Knockdrin Demesne, April 1892, R. F. Scharff.

CONNAUGHT.

Roscommon—Mote Park, Sept. 1904 ! Lord Crofton. Rockingham Gardens, Boyle, Sept. 1904 ! E. Clarke. Loughglynn, Oct. 1904 ! Hugh Kennedy.
Leitrim—A pallid form of the var. *grisea*, Mohill, July 1904 ! P. H. Grierson.
Sligo—Sparingly about Lough Gill, July 1904, A. W. Stelfox and R. Welch. Type and var. *subfusca*, garden, Moyview, Ballina, April 1889 ! Miss Warren.
Mayo E.—Manulla Junction, Sept. 1904 ! W. West.
Mayo W.—Achill Island ; also in gardens at the Colony and at the Signal Tower, Aug. 1886, J. G. Milne. The Demesne, Westport, Sept. 1904 ! J. O'Callaghan.
Galway E.—Abundant in gardens round Tuam (B. J. Clarke, Ann. Nat. Hist., 1843, p. 341). Type and var. *rufescens*, Clonbrock, Sept. 1904 ! Hon. R. E. Dillon.
Galway W.—Not uncommon on Gentian Hill, July 1895 (R. Standen, Irish Nat., Sept. 1895). Various places about Leenane, Apr. 1897, R. Welch. Type and var. *subfusca*, Kylemore Castle Gardens, Sept. 1904 ! W. Comfort. Type and var. *subfusca*, Roundstone and Aran Island, Sept. 1891, R. F. Scharff.

MUNSTER.

Clare—Woodpark, Scariff, Sept. 1904 ! N. F. Hibbert. Dromoland Castle Gardens, Sept. 1904 ! J. Carter.
Limerick—Limerick, Sep. 1904 ! G. Fogerty. Adare Manor, Oct. 1904 ! W. Bowles.
Tipperary N.—Shores of Lough Derg, Sept. 1904 ! G. J. Fogerty.
Tipperary S.—Ballingarry, June 1903, P. H. Grierson. Very common about Rock of Cashel, and also at Holycross Abbey, May 1898, R. Welch. Type and var. *fasciata*, Clonmel, Dec. 1885, Rev. A. H. Delap.
Waterford—Near Waterford, Sept. 1883 ! J. H. Salter. Garden, Bellevue House, Waterford, Sept. 1904 ! Miss Power. Alderton, Kilmanock, Sept. 1888 ! collected by Miss Glascott, G. A. Barrett-Hamilton.
Cork N.—Common, Blarney Castle, Sept. 1898, L. E. Adams. Convamore near Ballyhooley, Sept. 1904 ! J. McMillan. Tivoli near Cork, Sept. 1904 ! C. Baker. Queenstown, May 1891, R. F. Scharff.
Cork S.—Cork, south of river Lee, July 1904 ! R. Welch. Bantry, Sept. 1898, L. E. Adams. Skibbereen, Sept. 1904 ! J. J. Wolfe. Old ruin near Glengariff, May 1893, R. F. Scharff.
Kerry—Valentia Island, July 1886 ! Rev. A. H. Delap. Common over all the Kenmare and Upper Killarney districts, May 1898 ; also not uncommon in Mucksna Wood, July 1898, R. Welch. Cahirciveen, Sept. 1904 ! Miss M. J. Delap.

GERMANY.

Distributed almost throughout the country, living especially in gardens in Alsace, Baden, Bavaria, Brandenburg, Franconia, Hesse, Holstein, Nassau, Oldenburg, Pomerania, Pyrmont, Reuss, Saxony, Schleswig, and Thuringia. The record by Kleeburg for Elbing, East Prussia, would seem to really refer to *A. circumscriptus.*

NETHERLANDS.

Belgium—Recorded under various names as found in the provinces of Brabant, East Flanders, Hainault, Liége, Luxemburg, and Namur.

Holland—Reported from the Hague in South Holland, and Sluys-Kill in Zealand.

FRANCE.

Recorded as inhabiting Ain, Aisne, Alpes Maritimes, Ariége, Basses Pyréneés, Côte d'Or, Champagne Meridionale, Finistère, Gard, Gers, Gironde, Haute Garonne, Haute Loire, Haute Savoie, Hautes Pyréneés, Herault, Isère, Ille-et-Vilaine, Lozère, Loire Inférieure, Maine-et-Loire, Manche, Morbihan, Moselle, Nièvre, Nord, Oise, Pas-de-Calais, Pyréneés Orientales, Puy-de-Dôme, Rhone, Sarthe, Savoie, Seine, Seine Inférieure, Seine-et-Marne, Somme, Vendée, Vienne, and Vosges.

SWITZERLAND.

Reported from gardens, etc., in the cantons of Berne, Grisons, and Vaud.

ITALY.

Cited by Lessona, Pollonera, and others, from the Alps of Lombardy and Piedmont, from Western Liguria, Emilia, Venetia, Tuscany, Rome, and Calabria, but the southern records are probably very doubtful.

AUSTRO-HUNGARY.

Reported from Austria, Galicia, Hungary, and Moravia. The Transylvanian record by Bielz more probably refers to *A. circumscriptus.*

SPAIN AND PORTUGAL.

Spain—Reported as found in Catalonia, Galicia, Valencia, and Aragon.

Portugal—Morelet cites this species on the authority of Dr. Hidalgo, but Férussac's f. 3, pl. 8a, cited by Hidalgo as representing his species, is *A. circumscriptus.*

BALKAN PENINSULA.

Servia—Recorded by Möllendorff from Serpentinberge, Central Servia.

SCANDINAVIA.

Norway—Common in the Christiania, Christiansand, and Hamar districts in South Norway; it has also been recorded from Trondenaes on Hindó, in the Amt of Tromsó, and from Björn in Nordland.

Sweden—According to Lindström it is found on the Isle of Gothland, and Malm records it from Gothenburg, Christianstad, Lund, Orebro, Ronneby, as well as Carlsbergs Park, and other places around Stockholm.

Denmark—According to Malm it is common in Kongens Have, Copenhagen, and about Viborg in Jutland.

RUSSIA.

Recorded from Kharkov, Moscow, and Courland by Kaleniczenko and others, but erroneously, as it has not yet penetrated so far east; it has, however, been found on the Aland Isles, and the record by Slosarski of its occurrence at Olkusz in Poland, may possibly really refer to this species and not to *A. circumscriptus.*

Siberia—Recorded as generally distributed in Amurland, and also as inhabiting Mikoulina on the Jenissei, but probably erroneously.

NORTH AFRICA.

Morocco—Morelet records an *Arion* "resembling our *A. hortensis*" from Cape Spartel (Journ. de Conch., 1880, p. 15).

Algeria—A doubtful specimen from Algiers (Collinge, Pr. Mal. Soc., 1898, p. 337).

NEARCTIC REGION.

Locally plentiful in Massachusetts at Boston and New Bedford; found also at Poughkeepsie and New York in New York State; at Philadelphia in Pennsylvania, and in greenhouses at Seattle, Washington Territory.

ETHIOPIAN REGION.

South Africa—Collinge has recorded *A. fuscus* O. F. Müller, and may intend to indicate this species, or possibly *A. subfuscus.*

AUSTRALASIAN REGION.

New Zealand—Erroneously recorded by Mr. Musson as plentiful at Auckland, crawling about after rain; the species occurring there proves to be *A. intermedius.*

Distribution of *Arion hortensis* Fér.

In the Counties and Vice-Counties of the British Isles.

ENGLAND AND WALES.

Channel Isles

PENINSULA
1 Cornwall W.
2 Cornwall E.
3 Devon S.
4 Devon N.
5 Somerset S.
6 Somerset N.

CHANNEL
7 Wilts N.
8 Wilts S.
9 Dorset
10 Isle of Wight
11 Hants S.
12 Hants N.
13 Sussex W.
14 Sussex E.

THAMES
15 Kent E.
16 Kent W.
17 Surrey
18 Essex S.
19 Essex N.
20 Herts.
21 Middlesex
22 Berks.
23 Oxford
24 Bucks.

ANGLIA
25 Suffolk E.
26 Suffolk W.
27 Norfolk E.
28 Norfolk W.
29 Cambridge
30 Bedford
31 Hunts.
32 Northampton

SEVERN
33 Gloucester E.
34 Gloucester W.
35 Monmouth
36 Hereford
37 Worcester
38 Warwick
39 Stafford
40 Salop

SOUTH WALES
41 Glamorgan
42 Brecon
43 Radnor
44 Carmarthen
45 Pembroke
46 Cardigan

NORTH WALES
47 Montgomery
48 Merioneth
49 Carnarvon
50 Denbigh
51 Flint
52 Anglesey

TRENT
53 Lincoln S.
54 Lincoln N.
55 Leic. & Rutld.
56 Notts.
57 Derby

MERSEY
58 Cheshire
59 Lancashire S.
60 Lan'shire Mid

HUMBER
61 S.E. York
62 N.E. York
63 S.W. York
64 Mid W. York
65 N.W. York

TYNE
66 Durham
67 Northumb. S.
68 Cheviotland

LAKES
69 Westmorland and L. Lancs.
70 Cumberland
71 Isle of Man

SCOTLAND.

W. LOWLANDS
72 Dumfries
73 Kirkcudbright
74 Wigtown
75 Ayr
76 Renfrew
77 Lanark

E. LOWLANDS
78 Peebles
79 Selkirk
80 Roxburgh
81 Berwick
82 Haddington
83 Edinburgh
84 Linlithgow

E. HIGHLANDS
85 Fife & Kinross
86 Stirling
87 Pth. S. & Clkn.
88 Mid Perth
89 Perth N.
90 Forfar
91 Kincardine
92 Aberdeen S.

E. HIGHLANDS
93 Aberdeen N.
94 Banff
95 Elgin
96 Easterness

W. HIGHLANDS
97 Westerness
98 Main Argyle
99 Dumbarton
100 Clyde Isles
101 Cantire
102 Ebudes S.
103 Ebudes Mid
104 Ebudes N.

N. HIGHLANDS
105 Ross W.
106 Ross E.
107 Sutherland E.
108 Sutherland W
109 Caithness

NORTH ISLES
110 Hebrides
111 Orkneys
112 Shetlands

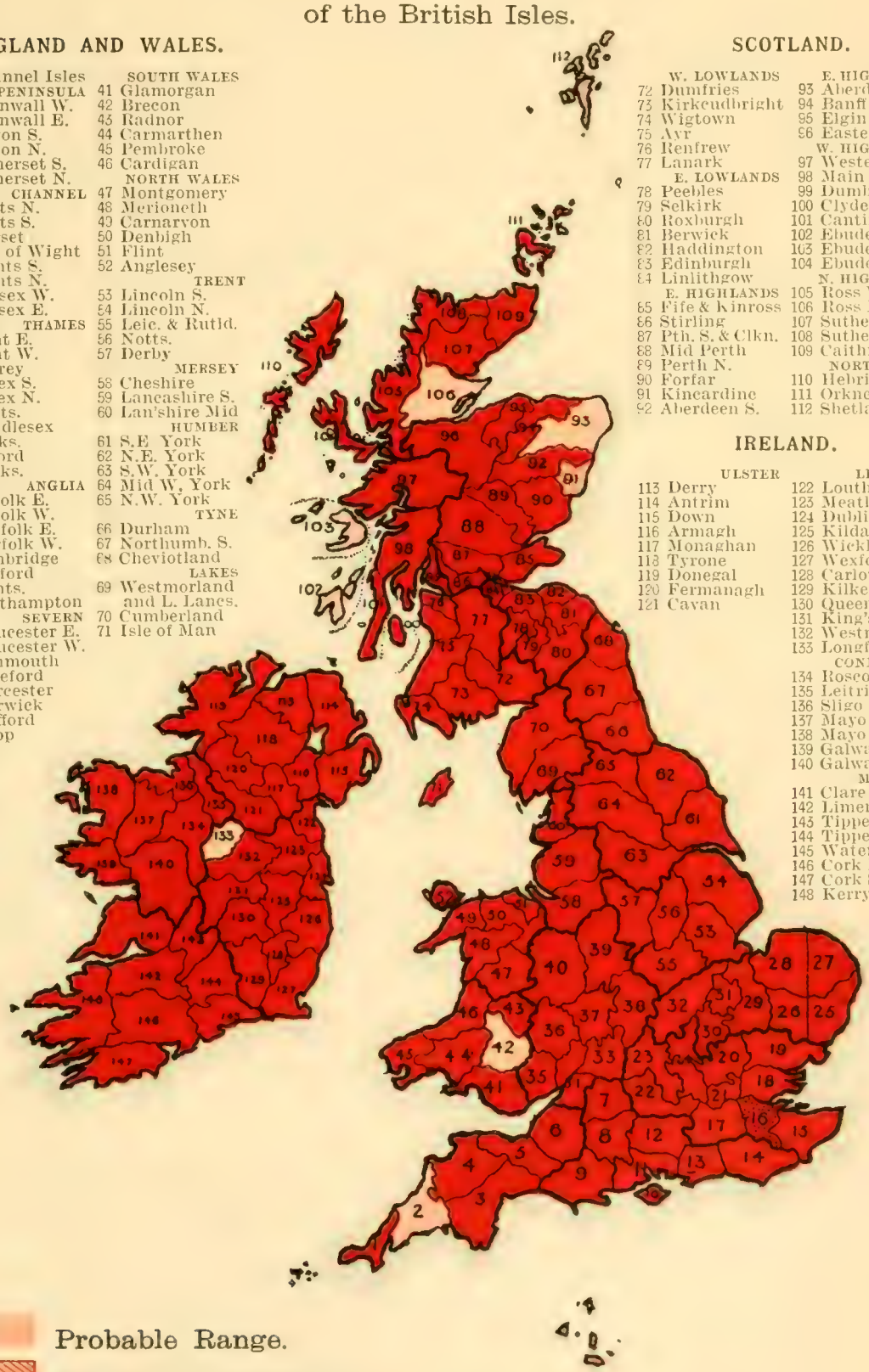
IRELAND.

ULSTER
113 Derry
114 Antrim
115 Down
116 Armagh
117 Monaghan
118 Tyrone
119 Donegal
120 Fermanagh
121 Cavan

LEINSTER
122 Louth
123 Meath
124 Dublin
125 Kildare
126 Wicklow
127 Wexford
128 Carlow
129 Kilkenny
130 Queen's Co.
131 King's Co.
132 Westmeath
133 Longford

CONNAUGHT
134 Roscommon
135 Leitrim
136 Sligo
137 Mayo E.
138 Mayo W.
139 Galway W.
140 Galway E.

MUNSTER
141 Clare
142 Limerick
143 Tipperary N
144 Tipperary S.
145 Waterford
146 Cork N.
147 Cork S.
148 Kerry



Probable Range.

Recorded Distribution.

Distribution verified by the Authors.

Fossil Distribution.

Arion circumscriptus Johnston.

1819 **Arion** *hortensis* var. *α* and *β* Férussac, Hist. Moll., pl. 2, f. 6, and pl. 8A, ff. 2-4.
1828 — **circumscriptus** Johnston, Edinburgh New Philos. Journ., v., p. 76.
1837 — *marginatus* Kickx, Bull. Acad. Roy. Soc. Bruxelles, iv., p. 139.
1852 — *leucophæus* Normand, Descr. Six Limac. Nouv., p. 6.
1864 — *hortensis* var. *grisea* Bourguignat, Malac. Gr. Chartr., pl. 1, f. 9-11.
1868 — *bourguignati* Mabille, Rev. et Mag. Zool., xx., p. 138.
1868 — *neustriacus* Mabille, op. cit.
1885 — (*Carinella*) *bourguignati* Pollonera, Moll. Terr. Piemonte, p. 28.
1887 — *celticus* Pollonera, Spec. Nuov. Arion Europei, p. 19, ff. 11, 22, 33, 37.
1887 — *nilssoni* Pollonera, op. cit., p. 19, ff. 33-34.
1889 — *ambiguus* Pollonera, Nuove Contr. Arion Europei, p. 15, ff. 16-19.
1890 — *subcarinatus* Pollonera, Recensem. Arionidæ Paléarct., p. 27.
1822 *Limax fasciatus* γ Nilsson, Hist. Moll. Sveciae, p. 4.
1868 *Prolepis hortensis* Malm, Limac. Scand., pl. 2, f. 5.
1881 *Geomalacus bourguignati* Locard, Moll. Ain, p. 11.

Geo: Johnston

HISTORY.—*Arion circumscriptus* (*circum*, around; *scriptum*, marked) in allusion to the distinct lateral black zone almost encircling the body, is here associated with the late Dr. G. Johnston, of Berwick, the author of the excellent work, an "Introduction to Conchology," who first differentiated and named the species. It is also probably the *Arion hortensis* vars. *α* and *β* of Férussac and the *Limax fasciatus* var. γ of Nilsson, and is said by Pollonera to be the same as *Geomalacus bayani* Jousseaume and *Arion dupuyanus* of Bourguignat, but the latter species is described as possessing a strong keel and yellowish foot, characters which are somewhat against this allocation.

The sub-genus *Carinella* has been instituted by Mabille for the reception of the present species and closely-allied forms, a grouping based upon the possession of a dorsal keel during the earlier stages of growth, but which may occasionally persist to adult life.

Diagnosis.—*Arion circumscriptus* is larger, broader, and far paler in colour than *A. hortensis*, the species with which it has been so long confounded. The distinctly white foot of the present species is also one of its most striking characteristics.

INTERNALLY, it is distinctly separated from its ally, *Arion hortensis*, by its very elongate and narrow ATRIUM, pointed SPERMATHECA, slender and rather uniform EPIPHALLUS, and shorter FREE OVIDUCT.

Original Description.—*Arion circumscriptus.* Body greyish-black, spotted, with a black fascia round the shield and body, the respiratory aperture anterior.

Body, 1 or 1½ inch long, not keeled, nor much narrowed at the tail; greyish-black, marbled, with a narrow fascia surrounding the back and shield; sides bluish-grey; foot white, opaque; tentacula rather short, black; respiratory aperture

placed very forward on the shield, which is entire; mucus pore very distinct, above the tail; the young are white or straw coloured, with blackish head and tentacula. Habitat: Moist meadows, hedgebanks, etc., common.

We have found it very uniform and constant in its character, though it may possibly be the *Arion ater* in an immature state.—G. JOHNSTON, Edinb. New Phil. Journal, 1828, vol. v., p. 76.

Description.—ANIMAL of the *Arion* shape, but stouter especially when contracted and with a much softer skin than its close ally, *Arion hortensis*; about thirty mill. in length when adult and fully extended; of a pale creamy-grey colour, darker grey dorsally, but shading to whitish towards the fringe; a black and sharply-defined lateral band extends the whole length of the body on each side, beneath which is sometimes an indistinct orange band, formed by pigment cells breaking through the skin; there is a slight mid-dorsal KEEL when young, which, however, gradually disappears during growth, but its place is almost invariably indicated by a line of pale mid-dorsal TUBERCLES, which contribute to form a pair of dorsal or inner bands; SHIELD granulose and bluntly rounded at both ends, bearing a disconnected continuation of the longitudinal body banding; BODY TUBERCLES rather long and slender; SOLE opaque, waxy white, and indistinctly tripartite, the median portion slightly darker and more transparent than the side areas, and occupying more than one-third of the width of the body; FOOT-FRINGE broad and white or pale-grey in colour, usually without perceptible lineolations, but sometimes the lineoles are clearly pigmented, especially at the caudal end of the body.

The SHELL is, as is usual in the genus, represented by a layer of limey-paste, but is sometimes found in the form of one or more solid lime particles of variable size.

INTERNALLY, the SUPRA-ŒSOPHAGEAL GANGLIA are very conspicuous, and united by a slender commissure, which, unlike *Arion ater*, is not opaque-white or enlarged medially as in that species. The body cavity is whitish and therefore does not display so strikingly the exquisite lace-like network of milk-white arteries and arterioles, a whiteness due to the dense investment by lime particles of their outer sheaths, and which renders them so conspicuous in the dark form of *A. ater*; the AORTA is large and white, and runs 4 to 5 mill. before its bifurcation, the white investment commences abruptly, as no part of the VENTRICLE is white; the OTOCONIA are very numerous, oval in shape, with a central speck, and comparatively broader in proportion than those of *A. hortensis*.

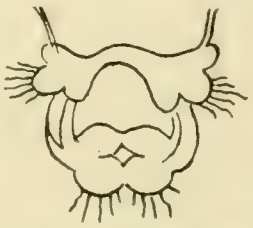


FIG. 232.—Nerve centres of *Arion circumscriptus* (greatly enlarged). Christchurch, Hants. S., Mr. C. Ashford).

The CEPHALIC RETRACTORS resemble those of *Arion hortensis*. The broad and flat TENTACULAR muscles have their roots four to five mill. apart to the right and left of the kidney, but are not quite symmetrical, either as to position of roots or width of muscle. The branch to the lower tentacle arises at about half the total length. The PHARYNGEAL retractor distinct, and usually dividing about half-way into two slender branches, which are fixed to the buccal bulb; the root arises about three mill. behind the kidney, about a millimetre to the right of the median line, and though sometimes broad the muscle is on the whole much narrower than the tentacular retractors.

FIG. 233.—Cephalic retractors of *Arion circumscriptus* × 4. (Christchurch, Hants. S., Mr. C. Ashford).

The REPRODUCTIVE ORGANS display an oval or roundish OVOTESTIS, with relatively large follicles, very dark in colour, especially in the interstices, the whole being completely imbedded in the LIVER; the HERMAPHRODITE DUCT is rather long and slender, but scarcely sinuous; ALBUMEN GLAND very large and broad, of a dirty semi-transparent yellow; OVISPERMATODUCT thick and very stiffly flexed; OVIDUCT yellowish and very broad; SPERM DUCT or prostate composed in the upper part of small, longish, and somewhat separated follicles; FREE OVIDUCT short, and of uniform width; EPIPHALLUS stiff, and not very slender, gradually enlarging downwards, but without the bulbous base of *A. hortensis*, and shewing the internal folds through its substance as white longitudinal lines; VAS DEFERENS rather long; SPERMATHECA inversely spatulate, the stem short and thickening downwards; ATRIUM very long, somewhat constricted and uniform in width, with a conspicuous yellow glandular investment.

The ALIMENTARY SYSTEM has the usual triodromous intestinal coiling, but the tracts are shorter, and therefore do not so palpably shew the great spiral torsion to which the viscera have been subjected; the ŒSOPHAGUS is about three mill. in length, and fused to the PHARYNX; the CROP is dirty-brown, about nine mill. long, and two mill. in diameter, closely wrinkled transversely, with the white salivary glands attached to each side; the DIGESTIVE GLAND is light brownish-ochre, and forms the hindmost point, but a lobe reaches far forward.

FIG. 234. FIG. 235. FIG. 236. FIG. 237.

Alimentary canal and Reproductive organs of *Arion circumscriptus* Johnst. and *Arion ambiguus* Pollonera.

FIG. 234.—Alimentary canal of *A. circumscriptus* Johnst. × 3. (Christchurch, Mr. C. Ashford).
FIG. 235.—Reproductive organs of *A. circumscriptus* Johnst. × 3. (Christchurch, Mr. C. Ashford).
FIG. 236.—Proximal end of Reproductive organs of *A. ambiguus* × 4. Bardonecchia, Piedmont (after Pollonera).
FIG. 237.—Proximal end of Reproductive organs of *A. ambiguus* var. *armoricana* × 4. Brest, France (after Pollonera).
a.g. albumen gland; *ep.* epiphallus; *ot.* ovotestis; *ov.* oviduct; *s.d.* sperm duct; *sp.* spermatheca with retractor; *v.d.* vas deferens; *v.p.* vestibular gland.

The MANDIBLE or jaw is rather more than a mill. broad, and much resembles that of *A. hortensis* in general aspect, but in the particular example was thicker in substance, and of deep brown colour. It is of the usual crescentic shape, and strongly arcuate from front to back, with about ten vertical ribs or thickenings, which strongly denticulate the upper margin, and are more evenly distributed over the whole anterior surface of the jaw than in *A. hortensis*; the lower half of the jaw is much more deeply coloured than the top, which is of an amber colour, with the darker ribs very apparent thereon.

FIG. 238.—Mandible or jaw of *Arion circumscriptus* × 20. (Stroud, Mr. E. J. Elliott).

The LINGUAL MEMBRANE is about three mill. long, and about one mill. in width, and composed of about 125 slightly-curved transverse rows of denticles, each row formed by a distinctly tricuspid median tooth, the strong and well-developed mesocone with lateral expansions; the lateral teeth are about seventeen in number, obscurely tricuspid, showing a powerful mesocone with lateral expansions, an enlarged ectocone, and a more than correspondingly reduced endocone, without cutting-point; the marginals are bicuspid, bearing a strong mesocone and a distinct and pointed ectocone, while the few extreme marginals are quite embryonic in character.

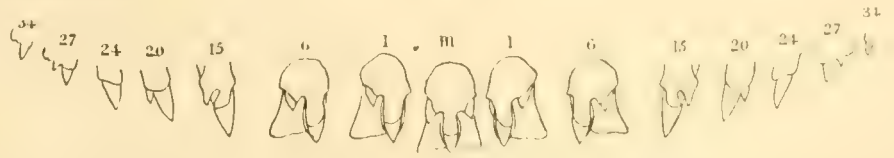


FIG. 239.—Representative denticles from a transverse row of the lingual teeth of *A. circumscriptus* × 180. The animal collected at Stroud by Mr. E. J. Elliott, and the palate prepared by Mr. Neville.

The dental formula of a Stroud specimen collected by Mr. E. J. Elliott is

$$7 + \tfrac{10}{2} + \tfrac{17}{2\text{-}3} + \tfrac{1}{3} + \tfrac{17}{2\text{-}3} + \tfrac{10}{2} + 7 \times 125 = 8{,}625.$$

Reproduction and Development.—The congress of this species has been observed by Mr. E. J. Lowe, who remarks that the act is, as in *Arion hortensis*, very transient, scarcely occupying more than forty to forty-five seconds, but the spermatophore has not as yet been noticed or described. The eggs are deposited in moist sheltered positions, in clusters of twelve to fifteen, adherent by a sticky mucus, and have been observed from June up to November; they are oval, but somewhat variable both in shape and size, usually of a semitransparent white when first deposited, but gradually becoming opalescent or pearly. The young are said to be usually of a delicate grey, and to show the lateral banding from birth, as well as a distinct dorsal keel, the latter, however, is usually gradually lost during growth, its position being represented by a line of whitish mid-dorsal tubercles at maturity, a state which would seem to be attained about June and July.

Food and Habits.—This species is much less slimy than *Arion hortenis*, and unlike that species, is essentially a frequenter of grass fields or uncultivated ground, and not common in gardens. Like its ally, it however is a truly geophilous and nocturnal species, and in feeding only ascends a short distance up a plant, though capable of spinning mucous threads both in its young and adult state.

According to Baudon, it is rather common on decaying tree-trunks, under fallen leaves, and in the stem and cap of large mushrooms of which and other fungi *A. circumscriptus* is particularly fond.

It is a very sluggish and slow species, bunching up and spreading out its margins when at rest, and remaining inert as though torpid. It fixes itself to wood or stone, and according to Mr. Sherriff Tye, when humped-up in such places, looks like a grey pebble, and does not seek to escape from the place where it is fixed. According to Baudon, it often excavates little galleries in the earth under old trunks, in which many individuals may congregate, and which serve for retreats when the temperature is too hot or too cold.

Mabille describes it as a winter species in France, but in this country the winters are more severe and it is rarely met with at that season.

In captivity, Dr. Scharff found them to eat pieces of apple or rhubarb stalk, while in the garden they seemed to prefer to feed on the fallen and partially-decayed flowers of the pea, instead of attacking the living parts of the plant, like *A. agrestis*. Mr. Gain found this species to thrive and breed freely in confinement, but of 193 different kinds of food offered, only thirty-three were taken freely, while ninety were totally rejected.

Variation.—This species, being one of our more primitive and ancient forms, does not display that wealth of variation shown by the more recently evolved species, and although many varieties and even species have been set up, based chiefly upon the differing shades of dermal colouring, yet these are all clearly referable to two chief lines of variation ; one, which is chiefly found on cultivated land and gardens, is distinguished by the yellowish or brownish shade of its colouring, due to the development during growth of a number of reddish tegumentary pigment cells ; the other partakes of the grey tint of the typical form, but is liable to darken with age, and also displays more distinctly a certain concentration of the yellow pigment in the form of a supra-pedal longitudinal zone, and is a form more especially characteristic of the open country.

The slight dorsal keel, invariably present in the immature individuals, but which is usually gradually obliterated during growth, may, however,

at times persist to adult life, and this juvenile peculiarity in adults is not restricted to any particular form, but is probably more common amongst the individuals living near the outskirts of the geographical range of the species.

The *Arion celticus* and *A. nilssoni* of Pollonera would appear to be passage forms, linking the present species with *Arion hortensis*, possessing the yellowish foot and coloured slime of the latter, but with the internal organization in practical accord with that of *A. circumscriptus*, and should, therefore, be viewed as extreme forms of the latter species. It should, however, be noted that the external characters of *A. celticus* cannot be very well-marked, as specimens sent by Pollonera to Dr. Simroth as that species were found to be anatomically quite identical with *A. hortensis*.

VARIATIONS IN COLOUR AND MARKINGS OF ANIMAL.

Var. **leucophæa** Normand, Descr. Lim., 1852, p. 5.

Arion leucophæus Normand, op. cit.
Arion hortensis var. *grisea* Bourguignat, Mal. Grande Chartr., 1864, p. 30, pl. 1, f. 10.
Arion ambiguus and var. *armoricana* Poll., Atti. Acc. Sc. Torino, 1889, p. 15, ff. 16-19.
Arion subcarinatus Pollonera, Elenco Moll. Terr. Piem., 1885, p. 19.
Arion celticus Pollonera, Sp. nuov. Arion Europ., 1887, p. 19, ff. 11, 22, 33, 37.
Arion circumscriptus var. *atripunctatus* Cockerell, Conch., Sept. 1891, p. 31.
Arion circumscriptus var. *subalbida* Cockerell, Brit. Nat., 1891, p. 101.
Arion fasciatus var. *griseus* Collinge, Conch., 1892, p. 79.

ANIMAL of a grey colour, with darker lateral banding; foot-fringe with indistinct lineolations.

This variety which, with its more closely related forms, really represents the typical form, is sometimes found in an apparently dwarfed condition, possibly not fully grown, and in this state has been distinguished by Dr. Baudon as var. *minor*.

The var. **leucophæa** s.str., as defined by Van den Broeck, is ashy-grey, tinged with lilac, lateral bands dark.

The sub-var. **ambigua** is ashy-grey, fuscous dorsally, foot and foot-fringe whitish, with a tinge of yellowish, and faint lineoles.

The sub-var. **armoricana** has the sides pale ash colour, with back and shield maculated deep grey.

The sub-var. **atripunctata** has the shield punctate with black.

The sub-var. **grisea** is light silver-grey, with darker lateral banding.

The sub-var. **subalbida** is grey laterally, opaque-white below and darker dorsally, with dark lateral banding; sole and foot-fringe creamy-white.

The sub-var. **celtica** is darkly olivaceous above, sides pale grey with dark variegations and lateral banding, foot and foot-fringe yellowish, faintly lineolate.

ENGLAND.

Dorset—Sub-var. *ambigua* (T. D. A. Cockerell, Conch., Sept. 1891, p. 33). Sub-var. *subalbida*, Bailey Gate (id., op. cit., p. 35). Sub-var. *armoricana*, Sturminster Marshall (id., l.c.). Sub-var. *grisea*, Chideock, Bridport, Aug. 1885 ! A. Belt.

Hants. S.—Sub-var. *celtica*, Southampton, E. W. Swanton (Collinge, Conch., 1892, ii., p. 77).

Kent W.—Sub-var. *celtica*, Doddington, E. W. Swanton (Collinge, l.c.).

Hereford—Sub-var. *grisea*, Bishopswood Vicarage garden, June 1885 ! Rev. R. W. J. Smart.

Notts.—Sub-var. *celtica*, near Newark, W. A. Gain.

Lancashire S.—Sub-var. *grisea*, Knowsley near Liverpool, 1893 (W. E. Collinge, J. of Mal., 1893, p. 148).

York S.W.—Sub-var. *atripunctata*, Lofthouse, May 1887, G. Roberts (T. D. A. Cockerell, op. cit.).

IRELAND.

Meath—An uniformly grey variety, New Grange, June 1892, R. F. Scharff.

Dublin—Killakee, Oct. 1890; and garden, Leeson Park, Dublin, R. F. Scharff.

Galway W.—Roundstone, March 1891, R. F. Scharff.

CONTINENTAL DISTRIBUTION.

France—Var. *leucophæa* is found around Valenciennes in the department of the Nord, and at Troyes in the Aube (Moquin-Tandon, Hist. Moll., 1855, p. 15). Sub-vars. *celtica* and *armoricana*, about Brest, the former being erroneously said to replace *Arion hortensis* in that district. Sub-var. *grisea*, Grande Chartreuse, Isère.

Italy—Sub-var. *ambigua*, Bardonecchia and Boves, Piedmont. Sub-var. *subcarinata*, Rosazza, Piedmont.

Var. **neustriaca** Mabille, Rev. et Mag. Zool., Apl. 1868, p. 138.

Arion neustriacus Mabille, op. cit.
Arion hortensis β *alpicola* Férussac, Tabl., 1821, p. 18, pl. 8A, f. 3.
Arion circumscriptus var. *flavescens* Collinge, Conch., 1892, p. 27.
Arion nilssoni Pollonera, Sp. nuov. Arion Europ., 1887, p. 19, ff. 31, 34.
Prolepis hortensis Malm, Limac. Scand., 1868, pl. 2, f. 5.

ANIMAL reddish-grey, lateral fascia blackish, dorsal keel sometimes persistent to adult life ; foot-fringe without distinct lineolation.

This is the var. *subfusca* of Roebuck and the var. *flavescens* of Collinge, who describes the form as not uncommon. It is probably the var. *alpicola* of Férussac. The *Arion nilssoni* of Pollonera, is described as possessing a yellowish foot-fringe and as exuding a yellowish mucus.

The sub-var. **flavescens** is light brownish-yellow, with dark lateral band, and no perceptible lineoles, the yellow supra-pedal zone distinct.

The sub-var. **nilssoni** is yellowish-grey with cinereous banding, sides paler.

ENGLAND AND WALES.

Cornwall W.—Penmon, Falmouth, Apl. 1884 ! Herbert Fox.
Cornwall E.—Garden bank, St. Columb, May 1885 ! W. Vinson.
Middlesex—Churchyard Bottom Wood, Highgate, Apl. 1889 ! H. Wallis Kew.
Warwick—Ingon Grange, Stratford-on-Avon, Sept. 1884 ! R. J. Attye.
Stafford—Abundant about Cheadle, April 1886 ! F. B. Webb.
Merioneth—Hills above Barmouth, and Torrent Walk, Dolgelly, Aug. 1884 ! J. Hopkinson.
Leicester and Rutland—Hathern, Sept. 1884 ! C. T. Musson.
Notts.—Wollaton, Nov. 1884 ! and Worksop, April 1884 ! C. T. Musson.
Cheshire—Bowdon and Carrington, Dec. 1884 ! J. G. Milne.
York S.E.—Millington near Pocklington, April 1885 ! W. Denison Roebuck.
York N.E.—Abundant in Wilton Wood, May 1887 ! W. Denison Roebuck.
York S.W.—Holmfirth, Jan. 1885 ! H. E. Craven.
York Mid W.—Angram, Nidderdale ! at Starbotton ! and at an alt. of 900 feet on Buckden Pike, May 1886 ! W. Denison Roebuck.
Lancashire S.—Sub-v. *flavescens*, Knowsley, 1893 (Collinge, J. of M., 1893, p. 148).
Cheviotland—Tweedmouth, Dec. 1888 ! Rev. Dr. McMurtrie.

SCOTLAND.

Fife and Kinross—Sub-v. *flavescens*, St. Andrews (Collinge, J. of M., 1892, p. 27).

CONTINENTAL DISTRIBUTION.

France—Under stones at Sèvres, Bellevue, and Charenton, Seine; also in the departments of the Aisne and Oise.
Switzerland—Sub-var. *alpicola*, the Alps (Charpentier t. Moquin-Tandon).
Italy—Rivarossa, Piedmont (Pollonera, op. cit.).
Austro-Hungary—Sub-var. *alpicola*, Tatra in Galicia (Dybowski t. Jachno). Simroth describes a var. with orange-red dorsum and paler sides from Graz in Styria.
Sweden—Sub-var. *nilssoni*, South Sweden (Pollonera, op. cit.).

Var. **misera** Pollonera, Spec. nuov. Arion Europ., 1887, p. 24.

Arion bourguignati var. *miser* Pollonera, l.c.

ANIMAL whitish, or tinged with grey, with usual banding pale, and indistinct lineolation.

This sub-albine form is practically identical with the form named *pallida* by Mr. Roebuck.

ENGLAND AND WALES.

Carnarvon—Sub-var. *pallida*, Conway Castle, July 1883 ! W. Denison Roebuck.
Notts.—Sub-v. *pallida*, railway embankment, Colwick, Sep. 1884 ! C. T. Musson.
York S.W.—Sub-var. *pallida*, Penistone, Nov. 1889 ! Lionel E. Adams.
York Mid W.—Sub-var. *pallida*, Buckden Pike, at an alt. of 1,100 feet, May 1886 ! W. Denison Roebuck.

SCOTLAND.

Roxburgh—Sub-var. *pallida*, Langlee near Galashiels, Sep. 1904 ! J. Roseburgh.

IRELAND.

Queen's Co.—Sub-var. *pallida*, Maryborough, Oct. 1904 ! A. G. Stuart.

CONTINENTAL DISTRIBUTION.

Italy—Var. *misera*, Valley of Aosta and Valley of Great St. Bernard, Piedmont.

Geographical Distribution.—*Arion circumscriptus* being an earlier evolved species than *Arion hortensis*, has naturally therefore probably acquired a wider distribution, although its range is as yet far from being accurately known, as it has been in the past and is still so frequently confused with *A. hortensis*, under which name it is usually recorded.

It has been reported under its own name, or under that of *Arion hortensis*, from the British Isles, Germany, France, Belgium, Switzerland, Scandinavia, Austro-Hungary, North Italy, and Russia, but has not yet been detected in the Iberian Peninsula, where it will probably eventually be found.

It has also been observed in North America, where it has probably been accidentally introduced.

In the British Isles, it is distributed entirely over the country, and probably exists in all our comital and vice-comital areas.

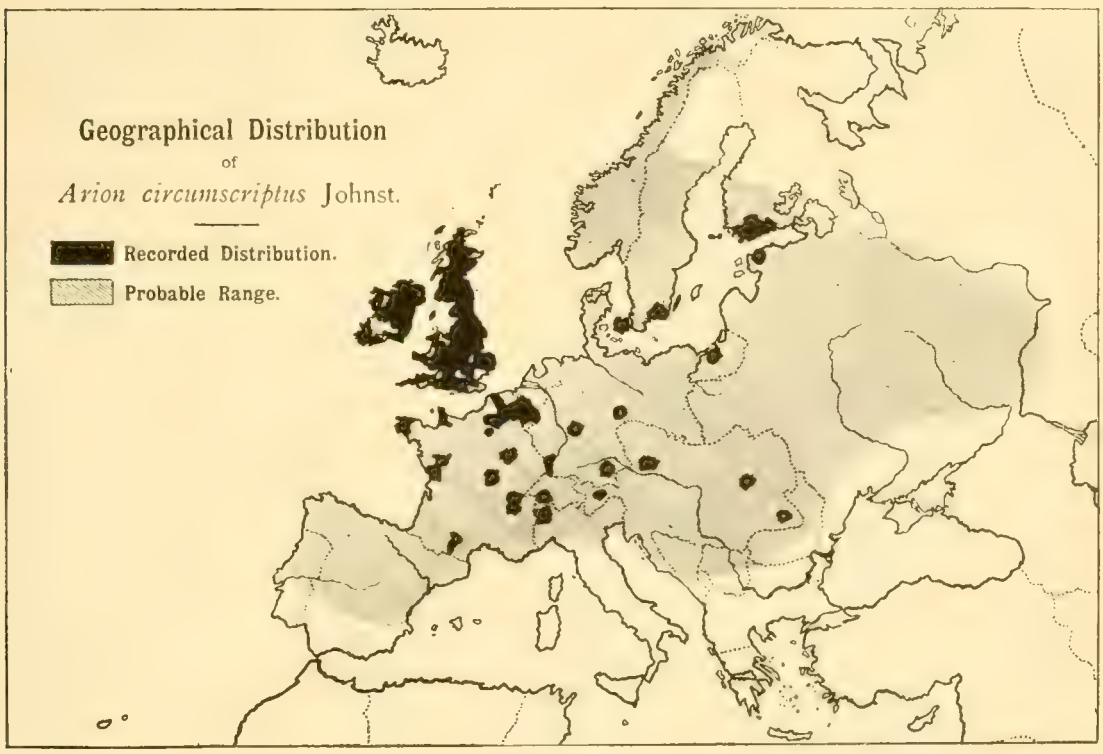


FIG. 240.

ENGLAND AND WALES.

Channel Isles—St. Sampson's, Guernsey, Sept. 1891 ! B. Tomlin.

PENINSULA.

Cornwall W.—Gardens, Truro, Apl. 1886 ! J. H. James. Penzance, Jan. 1905 ! Lionel E. Adams. Var. *neustriaca*, Penmon, Falmouth, Apl. 1884 ! H. Fox.

Cornwall E.—Type and var. *neustriaca*, garden bank, St. Columb, May 1885 ! W. Vinson.

Devon N.—Northam, Nov. 1885, W. A. Gain. Belstone, Okehampton, Sept. 1904 ! Rev. W. W. Mason.

Somerset S.—Porlock, Aug. 1892 ! Lionel E. Adams.

Somerset N.—Recorded in Adams' "Census," 1902, p. 222.

CHANNEL.

Wilts. N.—Clyffe Pybard, Swindon, Aug. 1904 ! Rev. E. H. Goddard.

Wilts. S.—Garden, Dunollie, Bourne avenue, Salisbury, Sept. 1904 ! A. R. D. Bacchus.

Dorset—Sub-var. *ambigua* (T. D. A. Cockerell, Conch., Sept. 1891, p. 33). Sub-var. *grisea*, Chideock, Bridport, Aug. 1885 ! A. Belt. Sub-var. *subalbida*, Bailey Gate (Cockerell, op.c., p. 35). Sub-var. *armoricana*, Sturminster Marshall (id., l.c.).

Hants. S.—Among dead leaves, garden, Christchurch, June 1886 ! and Hoborne, C. Ashford. Portsdown Hill near Portsmouth, Aug. 1886, W. Jeffery. Moderately common, Crabbe Wood, Aug. 1894, L. E. Adams. Hambledon, May 1904 ! C. S. Coles. Sub-var. *celtica*, Southampton, E. W. Swanton (Collinge, Conch., 1892, p. 77).

Hants. N.—Preston Candover, Nov. 1885 ! Rev. H. P. Fitzgerald.

Sussex W.—Garden, Ratham, July 1884 ! and Up Park, Sept. 1886 ! W. Jeffery.

THAMES.

Kent W.—Sevenoaks, Aug. 1887 ! S. C. Cockerell. Sub-var. *celtica*, Doddington, E. W. Swanton (Collinge, l.c.).

Surrey—Oxshott, May 1888 ! H. W. Kew. Punch Bowl and Grayswood (E. W. Swanton (C. Pannell, jr., J. of Conch., Apl. 1902, p. 169). Mickleham Downs and Epsom (id., op. cit., July 1903, p. 331).

Herts.—Codicote near Welwyn, Aug. 1904 ! Mrs. Blundell.

Middlesex—Bedford Park, Chiswick, Dec. 1884 ! T. D. A. Cockerell. Muswell Hill road, Apl. 1889 ! type and var. *neustriaca*, Churchyard Bottom Wood, Highgate, H. Wallis Kew.

Oxford—Banbury, Chipping Norton, Deddington, Bicester, Oxford, and Swincomb (Collinge, Conch., 1891, p. 14). Combe, July 1904 ! Rev. S. Spencer Pearce.

Bucks.—Abundant under stones by road-side, Olney, March 1893, L. E. Adams.

ANGLIA.

Suffolk E.—Woodbridge, June 1886 ! Rev. S. Spencer Pearce. Mendlesham, Thwaite, and Needham Market (A. Mayfield, J. of Conch., Apl. 1903, p. 295).

Norfolk E.—Common about Norwich, Aug. 1890, Lionel E. Adams.

Norfolk W.—King's Lynn, May 1887 ! and Gayton, June 1887 ! C. B. Plowright. Didlington Hall near Brandon, Oct. 1904 ! Hon. Mrs. Evelyn Cecil.

Cambridge—Grantchester, Sept. 1904 ! Hugh Watson.

Bedford—Hedgebank and wood near Luton, Nov. 1886 ! also General Cemetery, Luton, Apl. 1889 ! J. Saunders.

Northampton—Common in the county. Yardley Chase, Mch. 1893 ! L. E. Adams. Haselbeech, Rev. W. A. Shaw.

SEVERN.

Gloucester E.—Garden, Argyll House, Cirencester, Aug. 1904 ! Mrs. Blundell.

Gloucester W.—Common about Stroud, Oct. 1883 ! E. J. Elliott. Bristol, W. B. Waterfall.

Monmouth—Shirenewton Hall, June 1886 ! E. J. Lowe.

Hereford—Type and sub-var. *grisea*, vicarage garden, Bishopswood, June 1885 ! Rev. R. W. J. Smart. Garden, Ross, Sept. 1904 ! W. Blake.

Worcester—Cleeve Prior, May 1887 ! G. Sherriff Tye. Selly Oak, Feb. 1893 ! Lionel E. Adams.

Warwick—Solihull, Feb. 1893 ! Lionel E. Adams. Common about Sutton Coldfield, 1897, Albert Wood. Var. *neustriaca*, Ingon Grange, Stratford-on-Avon, Sept. 1884 ! R. J. Attye.

Stafford—Stafford Castle, Oct. 1885 ! Lionel E. Adams. Handsworth, in garden, June 1886 ! G. Sherriff Tye. Newton road, Birmingham, Feb. 1893 ! C. Oldham. Harborne, Guy Breeden, 1904. Type and var. *neustriaca*, Cheadle, abundant, Apl. 1886 ! F. B. Webb.

Salop—Whittington Castle ! and Oswestry, June 1885 ! Baker Hudson.

SOUTH WALES.

Glamorgan—Banks of river Ely, St. Fagan's, March 1885 ! F. W. Wotton.

Brecon—Erwood, Aug. 1904 ! J. Williams Vaughan.

Radnor—Penybout, Nov. 1903 ! F. Hall.

Carmarthen—Kidwelly, Dec. 1903, Rev. Ll. Davies.

Pembroke—Not uncommon, plantation, Tenby, Feb. 1898 ! A. G. Stubbs.

NORTH WALES.

Montgomery—Llanwddyn, May 1889 ! in fields, Llanymynech, and beneath larch timber in railway timber yard, Welshpool, June 1889 ! J. Bickerton Morgan.

Merioneth—Palé, Corwen, common in gardens and fields, May 1887 ! T. Ruddy. Type and var. *neustriaca*, hills above Barmouth ! and Torrent Walk, Dolgelly, Aug. 1884 ! J. Hopkinson.

Carnarvon—Slopes of Snowdon, Apl. 1887 ! J. Madison. Type and sub-var. *pallida*, Conway Castle, July 1883 ! W. Denison Roebuck.

Denbigh—Recorded in Adams' "Census," 1902, p. 222.

Flint—Grange road, Rhyl, July 1904 ! Rev. A. Steele Perkins.

Anglesey—Recorded in Adams' "Census," 1902, p. 222.

TRENT.

Lincoln S.—Ancaster, Apl. 1886 ! abundant by Old Hammond Beck, Frampton Fen near Boston, Sept. 1889 ! W. Denison Roebuck. Old Quarry, Great Ponton, Aug. 1902 ! R. Worsdale.

Lincoln N.—Skirbeck near Boston, Sept. 1884 ! Tothby Farm ! Ailby ! Burwell ! Muckton Chalk Pit ! and Sutton-in-the-Marsh, Apl. 1886 ! also Harrington Hill ! Well Vale ! Bag Enderby ! and Grisel Bottom near Louth, Sept. 1889 ! W. Denison Roebuck. Tothill, May 1888 ! Miss Susan Allott. Hibaldstow, Apl. 1903 ! Mason and Peacock.

Leicester and Rutland—Var. *neustriaca*, Hathern, Sept. 1884 ! C. T. Musson.

Notts.—Plentiful in gardens and fields about Tuxford, June 1888 ! W. A. Gain. Cleveland Hill, West Markham ! Pleasley Vale ! and Cresswell Crags, Apl. 1884 ! railway embankment near Colwick ! Beauvale Abbey ! and wood at Wollaton, Nov. 1884 ! by old ruined chapel, Houghton ! and Mapperley, May 1885 ! also at Staunton, June 1886 ! C. T. Musson. Corporation Gardens, Wells road, Nottingham, June 1885 ! and Hunger Hill Gardens, Nottingham, May 1888 ! G. W. Mellors. Var. *neustriaca*, Worksop, April 1884 ! Wollaton, Nov. 1884 ! and sub-var. *pallida*, Colwick, Sept. 1884 ! C. T. Musson. Sub-var. *celtica*, near Newark, W. A. Gain.

Derby—Markland Grips and Pleasley Vale, Apl. 1884 ! C. T. Musson. Numerous on banks of river Goyt, Marple ! and Fairfield near Buxton, Sept. 1885 ! J. G. Milne. Clifton near Ashbourne, June 1889 ! and near Hathersage, Aug. 1889, L. E. Adams.

MERSEY.

Cheshire—Garden, Broad road, Sale, May 1885 ! and Northwich, Oct. 1885 ! Charles Oldham. Garden, Liverpool road, Chester, Oct. 1887 ! Brockton Tomlin. Marple, May 1891 ! L. St. George Byne. Bowdon, May 1885 ! Peover near Knutsford, Aug. 1885 ! and Dunham Park, Oct. 1885 ! also var. *neustriaca*, Bowdon and Carrington, Dec. 1884 ! J. G. Milne.

Lancashire S.—River-bank, Walton-le-Dale, June 1889 ! and Farington, Oct. 1889 ! W. H. Heathcote. Type and sub-vars. *grisea* and *flavescens*, Knowsley near Liverpool, 1893 (W. E. Collinge, J. of Mal., 1893, p. 148).

Lancashire Mid—Banks of Easegill Beck, at foot of limestone scars, alt. 900 ft., Apl. 1887 ! W. Denison Roebuck. Fulwood, Feb. 1889 ! W. H. Heathcote. Over Wyresdale, at an alt. of 1,100 feet, Apl. 1903 ! Preesal near Fleetwood, July 1900 ! Mason and Peacock.

HUMBER.

York S.E.—Kilnsea, March 1884 ! W. Eagle Clarke. Allerthorpe, Filey, Lowthorpe, banks of Hornsea Mere, Bale Wood, Hedon, Cottingham, Humbledon, and North Grimston (T. Petch, Moll. East Riding, 1904, p. 131). Sledmere, Aug. 1891 ! F. W. Fierke. Driffield, June 1902, Rev. E. Percy Blackburn. Brough, May 1901 ! J. E. Crowther. Flamborough Head, May 1886 ! Kirkham Abbey, July 1889 ! and var. *neustriaca*, Millington near Pocklington, Apl. 1885 ! W. Denison Roebuck.

York N.E.—In the Tees Valley : Saltburn Wood ! and Kirkleatham, Sept. 1886 ! Tockett's Wood near Guisborough ! and Skelton Beck Valley, May 1887 ! Yearsby Wood, April 1889 ! Kilton Castle ! and Ingleby Greenhow ; type and var. *neustriaca*, abundant in Wilton Wood, June 1890 ! W. Denison Roebuck.

In Eskdale : Ramsdale Wood, Robin Hood's Bay, June 1886 ! W. D. Roebuck.

In Upper Derwent : Pickering Castle Hill ! Farwath Bridge ! and Levisham, Aug. 1886 ! also Harwood Dale, May 1904 ! W. Denison Roebuck. Scarborough, Aug. 1888, B. Tomlin. Hayburn Wyke, Aug. 1894 ! F. W. Fierke.

York S.W.—In Calderdale : Common, Park Wood, Elland, J. E. Crowther. Hebden Bridge, June 1904 ! W. D. Roebuck. Birkenshaw, Sept. 1888 ! G. Wingate. Type and var. *neustriaca*, garden, Holmfirth, Jan. 1885 ! H. E. Craven. Sub-var. *atripunctata*, Lofthouse, May 1887, G. Roberts (T. D. A. Cockerell, l.c.).

In the Don Valley : Dunford Bridge, July 1892 ! F. W. Fierke. Near Worsborough Reservoir, Sept. 1899 ! W. E. Brady. Darton, May 1904 ! W. Harrison Hutton. Burghwallis and Campsall, May 1886 ! W. Denison Roebuck. Doncaster ! Dunnington, June 1891 ! common at Kiveton Park, Conisborough, July 1891, type and var. *pallida*, Penistone, Nov. 1889 ! Lionel E. Adams.

In the Vale of Mersey : Canal side, Greenfield, June 1888 ! W. Denison Roebuck.

York Mid W.—In Airedale : Headingley, Nov. 1886 ! W. Nelson. Plentiful on banks of Leeds and Liverpool Canal, Armley, Oct. 1884 ! W. Denison Roebuck. Garden, Horsforth ! Fagley Wood and Thackley Wood, common, 1887 ; Nab Wood, Shipley Glen, and Seven Arches, Bingley, 1888 ; gardens, Apperley and Calverley, 1888, H. T. Soppitt.

In Wensleydale : Eavestone, Sept. 1886 ! J. Ingleby.

In Wharfedale : Kettlewell ! Starbotton ! and Buckden Pike ! up to 1,200 feet alt., May 1886 ; Leathley ! Troller's Gill ! and Rawdon Hill plantation near Harewood, Apl. 1887 ! Grassington, May 1891 ! and Cray Village, Aug. 1904 ! W. D. Roebuck. Oughtershaw, alt. 1,250 feet ! Hubberholme ! and Buckden Woods, common, Aug. 1904 ! Tom Petch. Var. *neustriaca*, Starbotton ! also on Buckden Pike, at 900 feet altitude ; and sub-var. *pallida*, at an elevation of 1,100 feet, May 1886 ! W. Denison Roebuck.

In Nidderdale: Near Linley ! and How Stean Beck ! type and var. *neustriaca*, near Angram May 1886 ! W. Denison Roebuck.

York N.W.—In Wensleydale: Scars on Coverdale Head, alt. 1,500 feet, May 1886 ! and Leyburn Shawl, April 1893 ! W. Denison Roebuck.

In Swaledale: Common by roadsides, Gunnerside, July 1884 ! abundant, Low Row ! and Feltham, Aug. 1885 ! W. Denison Roebuck.

In Teesdale: Greta Bridge road, Bowes, July 1884 ! W. Denison Roebuck. Rokeby, June 1892 ! W. Nelson.

In Ribblesdale: Wood End near Slaidburn ! Tosside in Bolland, Aug. 1885 ! Horton, 1892 ! and Cowgill, Denthead, Sept. 1904 ! W. Denison Roebuck. Helk's Wood, Ingleton, 1888, F. Rhodes.

TYNE.

Durham—Durham, Apl. 1884 ! near High Force, June 1884 ; and Croft, Apl. 1887 ! Baker Hudson. Dent Bank near Middleton, July 1884 ! and Langdon Beck, July 1884 ! also Spa Wood, Dinsdale, May 1887 ! W. Denison Roebuck.

Northumberland S.—Stocksfield-on-Tyne, May 1885 ! H. E. Craven. West Woodburn, by base of cliff; and on summit at an alt. of 800 feet, Sept. 1887 ! Richard Howse.

Cheviotland—Var. *neustriaca*, Tweedmouth, Dec. 1888 ! Rev. Dr. McMurtrie.

LAKES.

Westmorland and Lake Lancashire—Coniston, April 1887 ! S. C. Cockerell. Eggerslack Wood, Grange, Aug. 1897 (R. Standen, J. of Conch., Oct. 1898, p. 113).

Cumberland—Scales, Sept. 1890 ! Rev. J. Hawell.

Isle of Man—Douglas, Apl. 1904 (B. R. Lucas, J. of Conch., July 1904, p. 90). Injebreck Glen and Glen Maye, Sept. 1891 !

SCOTLAND. *WEST LOWLANDS.*

Dumfries—About Dumfries, Sept. 1890 ! and Moffat, Jan. 1891 ! W. Evans.

Kirkcudbright—Near Maxwelltown, Sept. 1890 ! W. Evans.

Wigtown—Springbank, Stranraer, Sept. 1890 ! W. Evans.

Ayr—By sandy shore, West Kilbride, Apl. 1888 ! Alex. Somerville. Girvan, Sept. 1890 ! W. Evans. Gourock Burn ; Seamill ; Portincross Rocks, Fairlie, and Largs, Rev. R. Godfrey, 1904.

Renfrew—Abundant under sleepers on abandoned railway, Shielhill Glen, Aug. 1886 ! W. Denison Roebuck.

Lanark—Possil Marsh, Aug. 1886 ! W. Denison Roebuck. Blackwood estate, Kirkmuirhill, Sept. 1904 ! N. B. Kinnear.

EAST LOWLANDS.

Peebles—Roadside, Eddleston, July 1889 ! tops of walls by roadside, Walkerburn ! and at Leadburn, Aug. 1889 ! W. D. Roebuck. Cademuir near Peebles, and Slipperfield Loch, West Linton, July 1890 ! also at Macbiehill, Feb. 1896 ! W. Evans.

Selkirk—Holylee ! and stone-heaps in Thornielee railway station, Aug. 1896 ! W. Denison Roebuck. Near Selkirk, Oct. 1890 ! W. Evans.

Roxburgh—Eildon Hills, Aug. 1886 ! W. Denison Roebuck. Jedburgh ! and type and sub-var. *pallida*, Langlee near Galashiels, Sept. 1904 ! J. Roseburgh.

Berwick—Roadsides near Earlston ! and Dryburgh Abbey ruins, Aug. 1886 ! W. Denison Roebuck. Cockburnspath, Sept. 1890 ! West Berwick ! and Coldingham Loch, Oct. 1890 ! W. Evans. Common, Eyemouth and Berwick (id., Moll. Berwick, 1895, p. 171).

Haddington—Under sleepers of abandoned railway, Drummore ! and Falside, Aug. 1886 ! W. Denison Roebuck. Longniddry, March 1890 ! Aberlady, May 1890 ! and Dirleton Common near North Berwick, Sept. 1890 ! W. Evans.

Edinburgh—Foot of Salisbury Craigs ! and plentiful at Levenhall, Aug. 1886 ! Blackford Hill ! and Bonally, Oct. 1888 ! W. Denison Roebuck. Plantations above Dreghorn, March 1890 ! Crichton, Feb. 1897 ! Balerno, April 1890 ! and Fullarton Lime Quarry, Nov. 1897 ! W. Evans.

Linlithgow—Roadside by Dalmeny Park, Aug. 1886 ! W. Denison Roebuck. Linlithgow, March 1890 ! Carribber, Feb. 1898 ! and Binny Craig, March 1898 ! W. Evans. Abundant on island in Linlithgow Loch, also found at Dalmeny, Hopetoun, Abercorn, Blackness, Dykenook, Winchburgh, Preston, Kinneil Mill, and woods, Jinkaboot, Woodcockdale, Cramond Bridge, Kirkliston, Graeme's Dykes, Redhill, Northbank, Bonytown Hills, quarry near Craigmailen Church, and about Bo'ness, Rev. R. Godfrey, 1902.

EAST HIGHLANDS.

Fife and Kinross—North Queensferry, Aug. 1886 ! W. Denison Roebuck. St. Andrews and Crail, Aug. 1890 ! Charlestown Lime Quarries ; Burntisland Quarries, and shores of Loch Leven, Feb. 1896, W. Evans. Sub-var. *flavescens*, St. Andrews (W. E. Collinge, Conch., 1892, p. 27).

Stirling—Polmont, Aug. 1890 ! W. Evans.

Perth S.—Callander, April 1888 ! Alex. Somerville. Aberfoyle, April 1896 ; Bridge of Allan, Feb. 1898, W. Evans. Balquhidder, July 1904 ! Rev. R. Godfrey.

Perth Mid—Loch Tay side, April 1887 ! Rev. J. E. Somerville. Crianlarich, Aug. 1888 ! A. Somerville. Glen Ogle, Lochearnhead, June 1904 ! Rev. R. Godfrey. Inver Dunkeld, Sept. 1904 ! A. Rodgers.

Perth N.—Blairgowrie, July 1890 ! W. Evans.

Forfar—Var. *neustriaca*, Montrose, July 1884 ! W. Duncan.

Kincardine—Banchory, July 1890 ! W. Evans.

Aberdeen S.—Drum Woods, Deeside, Oct. 1886 ! C. B. Plowright. Aberdeen Links, July 1890 ! W. Evans. Near Botanic Gardens, Old Aberdeen ! and garden, Rubislaw, Aberdeen, Oct. 1904 ! Geo. Sim.

Banff—Tomintoul, Nov. 1890 ! and Aberlour, Nov. 1892 ! Lionel Hinxman. Banks of river Avon, above Ballindalloch, Sept. 1891 ! W. Evans.

Elgin—Gardens, Elgin, Oct. 1890 ! Rev. G. Gordon. Cromdale near Grantown ! and Castle Roy by Netley Bridge, Aug. 1891 ! W. Evans.

Easterness—Glenurquhart, Inverness ! and Nairn, Jan. 1887 ! Rev. J. E. Somerville. Kincraig, Aug. 1889 ! Glen Feshie, Sept. 1889 ! and Dalwhinnie, at an alt. of 1,200 feet, June 1892 ! W. Evans.

WEST HIGHLANDS.

Westerness—Glenborrodale, Dec. 1890 ! J. J. Dagleish.

Main Argyle—Coast, south of Dunoon ! and Hunter's Quay, Aug. 1886 ! W. Denison Roebuck. Barbreck, June 1900 ; Blairghour Falls ; Loch Nant at high-water mark ; Ardchonnel ; Dunollie ; Glen Shieleach and Kilninver, July 1901, Rev. R. Godfrey.

Dumbarton—Foot of Dumbarton Castle rock ! and in a wood by railway, near High Mains, Aug. 1886 ! W. Denison Roebuck. Near Duntocher, Sept. 1888 ! and Garscadden, June 1889 ! Alex. Shaw.

Clyde Isles—Barone, Isle of Bute, Aug. 1886 ! W. Denison Roebuck. Brodick, Isle of Arran, April 1895 ! W. Evans.

Cantire—Near Loch 13, on the Crinan Canal, June 1890 ! A. McLaren.

Ebudes S.—Lough Ba House, near Port Charlotte, Islay, Nov. 1890 ! W. Evans.

Ebudes Mid—Iona, Oct. 1887 ! Rev. J. E. Somerville.

Ebudes N.—Eigg, Nov. 1890 ! W. Evans.

NORTH HIGHLANDS.

Ross E.—Between Bonar Bridge and Edderton, Feb. 1887 ! W. Baillie.

Sutherland E.—Golspie Burn, June 1884 ! Mound Rock, Sept. 1884 ! var. *neustriaca*, south side of Little Ferry, Dornoch, Oct. 1884 ! W. Baillie.

Sutherland W.—Durness ! also sandy sea-coast at Strathy and Farr, Oct. 1886 ! Rev. J. E. Somerville.

NORTH ISLES.

Hebrides—Churchyard, Eye, Stornoway, Sept. 1886 ! Alex. Somerville.

Orkneys—Harray, Dec. 1890 ! W. Evans. Stromness, Oct. 1904 ! J. Grant.

Shetlands—Moss Bank, Sept. 1904 ! Thos. Bowie.

IRELAND.

ULSTER.

Derry—Near Londonderry, J. N. Milne (R. F. Scharff, Irish List, 1892, p. 6). Straidarran, July 1904 ! P. H. Grierson. Garden, Downhill, Sep. 1904 ! C. N. Lynes. Common, Bellarena Woods, March 1904, R. Welch.

Antrim—Cushendun, common, May 1886 ! Whitehall, Broughshane, June 1886 ! Rev. S. A. Brenan. Rathlin Island, also commonly at Ballycastle and Murlough, May 1896 ! Lionel E. Adams. Cave Hill, 1893 ; Knockagh Mountain, May 1897 ; Derrykeighan, Feb. 1898 ; Kenbane, Oct. 1898 ; Murlough Bay and Whitepark Bay, June 1899 ; Brown's Bay, Larne, July 1899 ; Colin Glen, Oct. 1899 ; Glencorp, Mch. 1900 ; Ram's Island and Glenavy, May 1900 ; and common in the Ballycastle district, May 1902, R. Welch.

Down—Beech Hill, Newry, July 1904 ! Prof. R. J. Anderson. Ardglass, Dec. 1897 ; and about source of river Bann, near Deers Meadow, Mourne Mountain, at 1,100 feet alt., Jan. 1898 ; Dickson's Nursery, Belmont, Apr. 1898 ; Newcastle, June 1898 ; Ballinahinch Junction, Mar. 1899 ; Clandeboye Lake, May 1899 ; common, Hillsborough Old Castle, Apl. 1902 ; and rare, Lough Aghery, May 1904, R. Welch. Belvoir Park, 1894 ; Clonduff, Jan. 1898 ; Downpatrick, Mar. 1898 ; Ormeau Park, Belfast ; and rare, Killard Point, May 1898, A. W. Stelfox and R. Welch.

Armagh—Acton Glebe, Poyntzpass, Sept. 1904 ! Rev. W. F. Johnson. Newry, Jan. 1905 ! P. H. Grierson. Bessbrook, Apr. 1900, R. Welch.

Monaghan—Carrickmacross, July 1904 ! Drumreaske Park, Sept. 1904 ! P. H. Grierson.

Tyrone—Baronscourt, Sept. 1904 ! R. Bell

Donegal—Croaghross near Letterkenny, May 1889 ! H. C. Hart.

Fermanagh—Castlecoole, Enniskillen, Sept. 1904 ! Hon. C. L. Corry. Brookeborough, Sept. 1904 ! Sir Douglas Brooke. Not common, near Enniskillen, Sept. 1899, R. Welch.

Cavan—Mullagh, July 1904 ! P. H. Grierson.

LEINSTER.

Louth—Dromiskin, June 1904 ! Blackhall Demesne ! and Drogheda, Sept. 1904 ! P. H. Grierson.

Meath—Drumcondra ! and Nobber, July 1904 ! P. H. Grierson. Not common in Boyne Valley near Cavan, and Trim, July 1900, R. Welch. Sub-var. *grisea*, New Grange, June 1892, R. F. Scharff.

Dublin—Dublin, March 1886 ! J. R. Redding. Kill-of-the-Grange, Kingstown, April 1886 ! W. F. de Vismes Kane. Dellbrook near Dundrum, 1897, R. Welch. Rathgar and Bushy Park, Dublin, Sept. 1903, A. W. Stelfox and R. Welch. Type and var. *leucophæa*, Killakee and Leeson Park, Dublin, Oct. 1890, R. F. Scharff.

Kildare—Maynooth, Nov. 1891, R. F. Scharff.

Wicklow—Very rare, near Greystones; near the Sugar-Loaf, also at Altidore, July 1891, and Woodenbridge, March 1893, R. F. Scharff.

Wexford—Kilmanock, New Ross, Apl. 1888 ! G. A. Barrett-Hamilton. Wexford, Apl. 1891, R. F. Scharff.

Carlow—Fenagh House, Bagenalstown, Sept. 1904 ! Denis R. Pack-Beresford.

Kilkenny—Recorded in Adams' "Census," 1902, p. 234.

Queen's Co.—La Bergerie (B. J. Clarke, Ann. Nat. Hist., Nov. 1840, p. 203). Stradbally, Sept. 1904 ! sub-var. *pallida*, Maryborough, Oct. 1904 ! A. G. Stuart.

King's Co.—Clonmacnoise, E. Collier and R. Standen, July 1895. Charleville Forest, Tullamore, Sept. 1904 ! R. McKenna.

Westmeath—Common, Knockdrin Demesne, April 1892 ! R. F. Scharff. Moate, Sept. 1904 ! Mrs. Nugent.

CONNAUGHT.

Roscommon—Rockingham Gardens, Boyle, Sept. 1904 ! E. Clarke. Loughglynn, Castlerea, Oct. 1904 ! Hugh Kennedy.

Leitrim—Dromahaire Abbey, Sept. 1900, and Swiss Valley, Glencar, July 1904 ! A. W. Stelfox and R. Welch.

Sligo—Ballina, June 1891 ! Miss Amy Warren. Sligo, July 1904 ! A. W. Stelfox. Decidedly rare at Lissadill Glen; below Doonee Rock; Glencar; and Ballysodare, 1900 (R. Welch and A. W. Stelfox, Irish Nat., Sept. 1904, p. 186).

Mayo W.—Dugort, Achill Island, July 1904 ! P. H. Grierson.

Galway W.—Derrynasliggan Lodge, Leenane, April 1897, R. Welch. Roundstone, July 1895, E. Collier and R. Standen. Var. *grisea*, Roundstone, March 1891, R. F. Scharff.

Galway E.—Killereran (B. J. Clarke, Ann. Nat. Hist., Nov. 1840, p. 206). Clonbrock Forest and woodyard, June 1900, Hon. R. E. Dillon and R. Welch.

MUNSTER.

Tipperary S.—Holycross Abbey, May 1898, R. Welch.

Waterford—Old Dungarvon road, near Clonmel, Aug. 1886 ! Rev. A. H. Delap.

Cork S.—Carrigaline, May 1888 ! W. F. de Vismes Kane. Bantry, rare, June 1893, R. F. Scharff. Queenstown (id., Slugs of Ireland, p. 547). Common, Blarney and Glengariff, Sept. 1898, Lionel E. Adams.

Kerry—Valentia Island, July 1886 ! Rev. A. H. Delap. Muckross Demesne, May 1891, and Lough Caragh, R. F. Scharff. Sheen Wood, also at Kenmare and at Galway's Bridge, July 1898 (R. Standen, Irish Nat., Sept. 1898).

GERMANY.

Arion circumscriptus is recorded by Clessin as inhabiting the entire area; but records have only been noticed for Alsace, Bavaria, East Prussia, Nassau, and Saxony.

NETHERLANDS.

Belgium—*A. bourguignati* is recorded for Belgium, and as *A. leucophæus* for the provinces of Brabant, Hainault, Liége, and Namur.

FRANCE.

Arion circumscriptus is widely distributed throughout the country, but the recorded localities are as yet few and scattered; they embrace the departments of the Ain, Aisne, Haute Garonne, Maine et Loire, Manche, Nièvre, Oise, Seine, and Vendée. As *A. fuscus* var. *leucophæa* it is recorded for the Aube and the Nord; as *A. celticus* from Finistére; and as *A. hortensis* var. *grisea* from the Isére.

SWITZERLAND.

According to Clessin, it is a probable inhabitant of the country.

Distribution of *A. circumscriptus* Johnst.

In the Counties and Vice-Counties of the British Isles.

ENGLAND AND WALES.

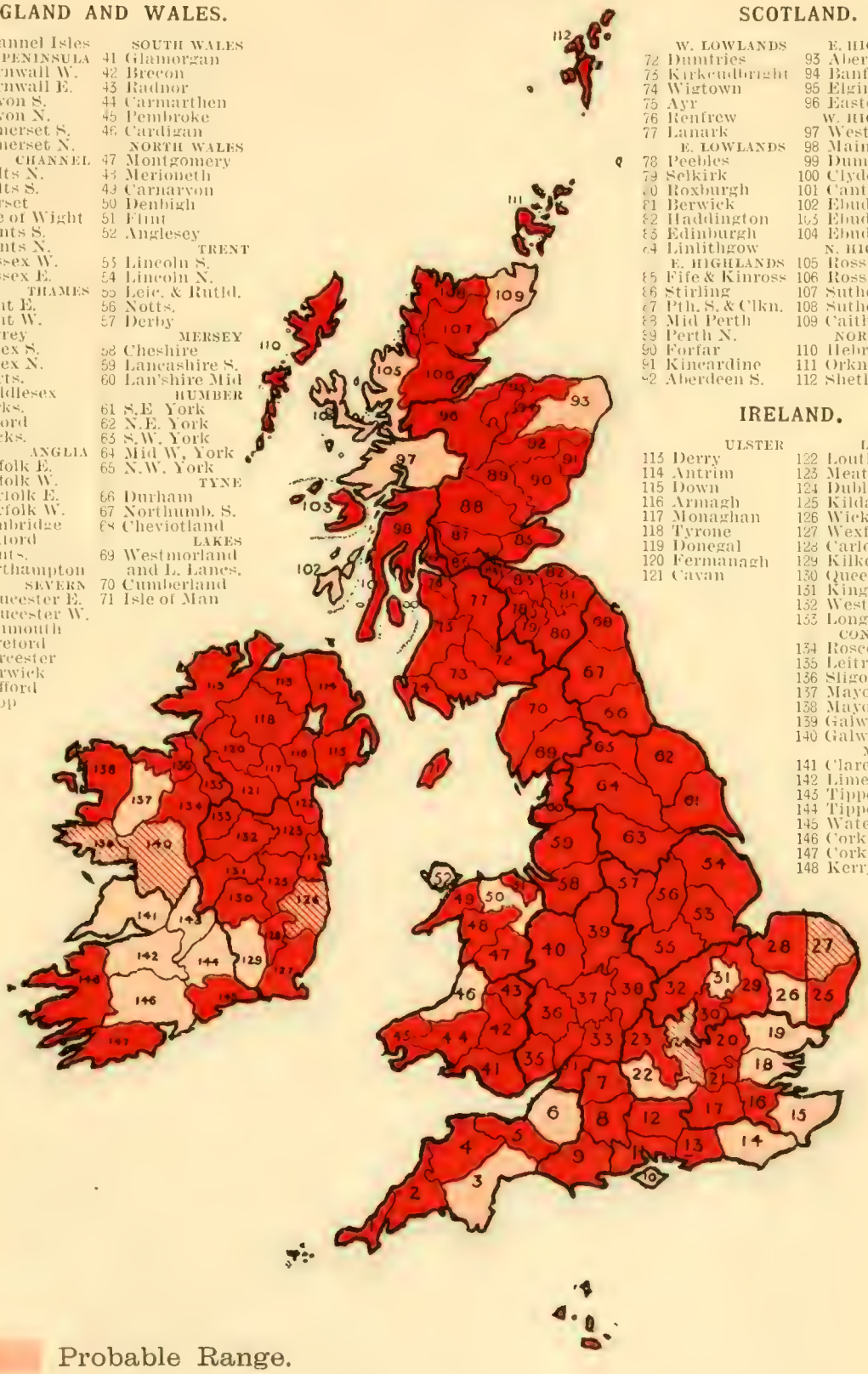
Channel Isles
PENINSULA
1 Cornwall W.
2 Cornwall E.
3 Devon S.
4 Devon N.
5 Somerset S.
6 Somerset N.
CHANNEL
7 Wilts N.
8 Wilts S.
9 Dorset
10 Isle of Wight
11 Hants S.
12 Hants N.
13 Sussex W.
14 Sussex E.
THAMES
15 Kent E.
16 Kent W.
17 Surrey
18 Essex S.
19 Essex N.
20 Herts.
21 Middlesex
22 Berks.
23 Oxford
24 Bucks.
ANGLIA
25 Suffolk E.
26 Suffolk W.
27 Norfolk E.
28 Norfolk W.
29 Cambridge
30 Bedford
31 Hunts.
32 Northampton
SEVERN
33 Gloucester E.
34 Gloucester W.
35 Monmouth
36 Hereford
37 Worcester
38 Warwick
39 Stafford
40 Salop
SOUTH WALES
41 Glamorgan
42 Brecon
43 Radnor
44 Carmarthen
45 Pembroke
46 Cardigan
NORTH WALES
47 Montgomery
48 Merioneth
49 Carnarvon
50 Denbigh
51 Flint
52 Anglesey
TRENT
53 Lincoln S.
54 Lincoln N.
55 Leic. & Rutld.
56 Notts.
57 Derby
MERSEY
58 Cheshire
59 Lancashire S.
60 Lan'shire Mid
HUMBER
61 S.E. York
62 N.E. York
63 S.W. York
64 Mid W. York
65 N.W. York
TYNE
66 Durham
67 Northumb. S.
68 Cheviotland
LAKES
69 Westmorland and L. Lancs.
70 Cumberland
71 Isle of Man

SCOTLAND.

W. LOWLANDS
72 Dumfries
73 Kirkcudbright
74 Wigtown
75 Ayr
76 Renfrew
77 Lanark
E. LOWLANDS
78 Peebles
79 Selkirk
80 Roxburgh
81 Berwick
82 Haddington
83 Edinburgh
84 Linlithgow
E. HIGHLANDS
85 Fife & Kinross
86 Stirling
87 Pth. S. & Clkn.
88 Mid Perth
89 Perth N.
90 Forfar
91 Kincardine
92 Aberdeen S.
E. HIGHLANDS
93 Aberdeen N.
94 Banff
95 Elgin
96 Easterness
W. HIGHLANDS
97 Westerness
98 Main Argyle
99 Dumbarton
100 Clyde Isles
101 Cantire
102 Ebudes S.
103 Ebudes Mid
104 Ebudes N.
N. HIGHLANDS
105 Ross W.
106 Ross E.
107 Sutherland E.
108 SutherlandW
109 Caithness
NORTH ISLES
110 Hebrides
111 Orkneys
112 Shetlands

IRELAND.

ULSTER
113 Derry
114 Antrim
115 Down
116 Armagh
117 Monaghan
118 Tyrone
119 Donegal
120 Fermanagh
121 Cavan
LEINSTER
122 Louth
123 Meath
124 Dublin
125 Kildare
126 Wicklow
127 Wexford
128 Carlow
129 Kilkenny
130 Queen's Co.
131 King's Co.
132 Westmeath
133 Longford
CONNAUGHT
134 Roscommon
135 Leitrim
136 Sligo
137 Mayo E.
138 Mayo W.
139 Galway W.
140 Galway E.
MUNSTER
141 Clare
142 Limerick
143 Tipperary N.
144 Tipperary S.
145 Waterford
146 Cork N.
147 Cork S.
148 Kerry



Probable Range.

Recorded Distribution.

Distribution verified by the Authors.

ITALY.

This species, which under the names of *Arion bourguignati*, *A. ambiguus* and *A. subcarinatus*, would seem to be confined to the alpine and sub-alpine districts of Piedmont, ascending to an altitude of 6,000 feet in the Valley of Aosta.

AUSTRO-HUNGARY.

Herr Clessin says that though only known to occur in Austria, it probably also inhabits Hungary, Bohemia, Moravia, and Galicia. It has, however, been recorded by Hazay from Kotlina-Thal in Hungary, and as abundant at Graz in Styria by Dr. Simroth. There is little doubt that the *Arion hortensis* recorded by Bielz from Transylvania really belongs to the present species, of which country Simroth also indicates it as an inhabitant.

SPAIN AND PORTUGAL.

Spain—*Arion hortensis* is recorded by Prof. Hidalgo from various localities in Spain, but the figure cited as representing his species (Férussac, Hist. Moll., pl. 8a, f. 3) is *Arion circumscriptus*.

BALKAN PENINSULA.

Roumania—Dr. Simroth indicates that the inhabited area of this species embraces the range of the Carpathians on the frontier of Roumania.

SCANDINAVIA.

Norway—Westerlund reports that under the name of *A. hortensis* it has been recorded for many localities in South Norway.

Sweden—Common at Ronneby in the province of Blekinge, found sparingly in the Island of Oeland, and extends up to 64° north latitude, or according to Simroth really extends as far north in Scandinavia as 69°.

Denmark—Westerlund reports it as existing on Zealand and Jylland.

RUSSIA.

Extends into Finland as far as 60° 45′ north lat. It is also recorded by Luther from Revel in Esthland, and according to Dr. Simroth extends eastward beyond Moscow to the Ural Mountains, and probably ranges well into Siberia.

NEARCTIC REGION.

New York—Abundant, Goat Island, Niagara Falls, May 1904, T. D. A. Cockerell.

District of Columbia—Var. *neustriaca*, garden, Washington; a prior owner of the garden was in the habit of importing plants from Europe (W. E. Collinge, Nautilus, May 1899, p. 9).

FIG. 241.—Banks of River Lagan, Belvoir Park, Ulster, a haunt of *Arion circumscriptus* (photo. by Mr. R. Welch).

Sub-Genus *Ariunculus* Lessona.

Arion intermedius Normand.

1852 *Limax* **intermedius** Normand, Descr. Limac. nouv., p. 6.
1855 **Arion** *flavus* Forbes & Hanley, Hist. Moll. Anim., iv., p. 9, pl. F.F.F., f 2.
1881 — *verrucosus* Brevière, Journ de Conch., p. 310, pl. 13.
1884 — *mabillianus* Baudon, Journ. de Conch., p. 8.
1885 — *minimus* Simroth, Zeitschr. Wissensch. Zool., p. 289, pl. 7, f. 41.
1889 — *mollerii* Pollonera, Nuov. Contrib., p. 19, f. 7–10.
1867 *Geomalacus intermedius* Mabille, Rev. et Mag. Zool, p. 57.
1867 — *hiemalis* Drouet, Moll. Côte-d'Or, p. 27.
1868 — *mabillei* Baudon, Journ. de Conch., p. 142.
1869 — *vendeanus* Let., Rev. et Mag. Zool., p. 51.

HISTORY.—*Arion intermedius* (*intermedius*, intermediate) was first clearly discriminated by Normand in 1852, but his description was overlooked. It is the *Arion incommodus* of Hutton, and is also the *Arion flavus* of Alder, Moquin-Tandon, Forbes and Hanley, and other authors, but the species was not at that period generally accepted as valid, but relegated to the rank of a doubtful or spurious species by contemporary authors.

In 1885, Dr. Simroth independently differentiated the species, firmly established its specific status and applied to it the very appropriate name of *minimus*, which, unfortunately cannot be maintained.

A. intermedius is here associated with Dr. R. F. Scharff, M.R.I.A., of Dublin, its recent discoverer in this country, and the first in Britain to make known its really distinctive characters and wide distribution. He is also the author of many able papers upon Geographical distribution and the mollusca generally, as well as of the most authoritative and important work extant upon the Slugs of Ireland.

Arion intermedius belongs to the sub-genus *Ariunculus*, a group instituted by Lessona for the reception of a number of primitive little *Arions* occurring in Spain, Morocco, Sardinia, and in the higher regions of the Alps, and characterized by the position of the sexual orifice between the pulmonary aperture and the right ommatophore, and thus in this particular linking the *Arions* with *Geomalacus*, in which there is a similar arrangement.

Diagnosis.—*A. intermedius*, though presenting a certain resemblance to the two preceding species, is much softer and more gelatinous to the touch, smaller in size, paler in colour, more indistinct in banding, and exudes a bright yellow watery mucus, which tends to accumulate at opposite ends of the body. It is, however, sharply separated from all its congeners in this country by the possession of small but prominent dermal tubercles, each of which is surmounted by a jelly-like pointed spike, a peculiarity which has earned for it the title of the "hedgehog snail."

INTERNALLY, its organization bears, according to Simroth, most resemblance to that of *Arion subfuscus*, but is more simple and primitive. Perhaps the most sharply-marked difference is in the character of the mandible or jaw, which is very delicate, and displays a few exceedingly wide but only slightly convex ribs on its anterior surface.

Original Description.—*Limax intermedius.* Animal gris-jaunâtre pale. Extrémités surtout la postérieure, d'un beau jaune d'or. Côtes blanchâtres, marqués antérieurement de quelques petits points noirs, un peu espacés en ligne près du bord du pied. Tete, cou et tentacules gris-foncé ou noirâtres. Plan locomoteur granuleux. Mucus jaune. Limacelle blanche, opaque et rugueuse. Long. de l'animal, 15 à 20 mill.—NORMAND, Descr. Six Limac. Nouv., 1852, p. 6.

Description.—ANIMAL small but plumply built, about twenty or more mill. long when extended, and about three-and-a-half mill. broad; of a very pale yellowish grey or almost white, with or without a broad and dusky but ill-defined mid-dorsal streak, shading off downwards; ancestral lateral band on each side of the body, same shade as the back, shading off below to the yellowish-grey foot-fringe; SHIELD finely granulose, rounded at both ends, about one-third the length of the body, usually of a yellowish-tint, especially anteriorly, with pale dusky ill-defined mid-patch and lateral bands which meet behind; RESPIRATORY ORIFICE almost median, but the GENITAL APERTURE is nearly mid-way between the pulmonary orifice and base of right ommatophore, but below both; BODY TUBERCLES shortly polygonal and somewhat prominent, and in certain postures of the animal appear keeled, but under a lens the tubercles are seen to be surmounted by short white glandular spikes, which seem capable of individual movement, and whose erection appears dependent upon the will or emotion of the animal; when removed from its accustomed environment, placed on the hand, or during extension, all rugosity may disappear, and the skin appears smooth and shining, but the loosely implanted glandular crests give it the aspect of being dusted with flour; HEAD and NECK darker than DORSUM; CAUDAL GLAND conspicuous; TENTACLES small; FOOT-SOLE yellowish and undivided, the lateral areas yellow with slime, which also accumulates at the caudal end of the animal as well as on the anterior part of the shield; FOOT-FRINGE yellowish-grey, not visibly lineolate.

SHELL in British specimens usually represented by a thin and indistinct layer of limey-paste within the shell-sac, whose inner walls are densely speckled with lime-cells, although scarcely any free particles can be discerned. Normand and the Italian authors, however, describe the vestigial shells as white, opaque, and solid.

INTERNALLY, the walls of the cœlom are white and very thick for so small an animal, much thicker than in *A. circumscriptus*; the HEART, KIDNEY, and LUNG cavity are conformable with the generic character; the AORTA divides late, and is broad and white with lime particles, but there are no lime-charged hepatic arteries, such as form the beautiful white and lace-like tracery in *A. ater*; the lateral SINUSES of the cœlom are conspicuous, and correspond in position with the exterior lateral bands; the SUPRA-PEDAL GLAND is well imbedded in the tissues, and not more than half the length of the sole; the CEREBRAL GANGLIA with short commissures, which shew no signs of lime; the PEDAL GANGLIA are the largest and the most conspicuous of the SUB-ŒSOPHAGEAL group, while the BUCCAL pair are as usual separated by about their own diameters.

The CEPHALIC RETRACTORS are of the true *Arion* character. The two TENTACULAR muscles arise, about three mill. apart, from the under-surface of the posterior part of the mantle, the right one furthest back, as usual; they are flat, with very broad, fan-shaped roots, each divides early for the upper and lower tentacles; the PHARYNGEAL retractor arises further back, posterior to the mantle and nearly mid-dorsally, but inclined to the right side, it is much slenderer than the tentacular muscles, and forks a little later than half-way.

FIG. 243.—Cephalic retractors of *A. intermedius* Normand × 3. (Raheny, Co. Dublin, Dr. R. F. Scharff).

The ALIMENTARY SYSTEM has the ŒSOPHAGUS pigmented and partially fused with the PHARYNX, as is usual in the genus, but so much so that the parts have to be torn up to display the BUCCAL GANGLIA. The INTESTINAL CANAL is triodromous and the details of its arrangement and the amount of torsion or twisting it has

undergone are very similar to what is found in *A. circumscriptus*. The DIGESTIVE GLAND is greenish-yellow in colour, with its lobules not very coherent, and discharges into the STOMACH at the termination of the INGESTIVE TRACT.

FIG. 244. FIG. 245. FIG. 246. FIG. 247.

Alimentary and Reproductive organs of *Arion intermedius* Normand and *A. mollerii* Pollonera.

FIG. 244.—Alimentary canal of *A. intermedius* Normand × 4. (Raheny, Co. Dublin).
FIG. 245.—Reproductive organs of *A. intermedius* var. *appenina* × 2 (after Pollonera).
FIG. 246.—Reproductive organs of *A. minimus* Simroth × 3 (after Simroth).
FIG. 247.—Proximal end of the Reproductive organs of *A. mollerii*, magnified (after Pollonera).

The REPRODUCTIVE ORGANS are characterized by their simple outlines. The OVOTESTIS is roundish, with dark purplish acini, and rests upon the upper surface of the digestive gland, just beyond the distal end of the stomach; the HERMAPHRODITE DUCT is only very slightly sinuate, the proximal end thick; VAS DEFERENS somewhat short, enlarging into a moderately long and cylindrical EPIPHALLUS or spermatophore tract, without complications or windings, but which is furnished internally with longitudinally arranged rows of papillæ, from which it may be inferred that the SPERMATOPHORE is serrate, as in *Arion ater* and *A. subfuscus*; FREE OVIDUCT short and uniformly cylindrical; the GENITAL RETRACTOR is not easily found, but is attached to the free oviduct and stem of spermatheca, as is usual in the genus; the SPERMATHECA is somewhat globular with a funnel-shaped stem; the three terminal organs open into a moderately large light yellow glandular ATRIUM, which is somewhat quadrilateral in figure.

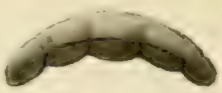


FIG. 248.—Mandible or jaw of *A. intermedius* Normand × 20. (Raheny, Dr. R. F. Scharff).

The MANDIBLE or jaw is very delicate, and less than a millimetre in width, slightly semi-lunar in shape, with attenuate but rounded ends, and of an amber colour, with five very broad but very feebly convex ribs, which extend over the whole surface of the jaw, and give an undulate aspect to the lower or cutting edge; a darker line extends medially across the jaw from side to side and parallel with the cutting margin, indicating the point of attachment of the elasma.

The LINGUAL MEMBRANE is about two mill. long, and bears about ninety somewhat curved transverse rows of teeth, each row composed of a distinctly tricuspid median tooth, the long and somewhat slender mesocone with lateral cutting expansions; the lateral teeth are as usual practically and strongly bicuspid, the endoconic cutting point being obsolete; they gradually pass by a series of transition teeth to the true marginals, which are strictly bicuspid, the endocone being gradually lost, but in the few extreme marginals the embryonic character is retained, the denticles being wide and showing indications of one or more ectoconic denticles.

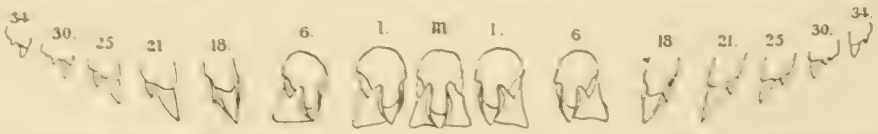


FIG. 249.—Representative denticles from a transverse row of the lingual teeth of *A. intermedius* × 180. The animal collected by Dr. Scharff, and the palate prepared by Mr. W. Moss.

The formula of a Raheny specimen collected by Dr. Scharff is

$$8 + \frac{6}{2} + \frac{20}{2\text{-}3} + \frac{1}{3} + \frac{20}{2\text{-}3} + \frac{6}{2} + 8 \times 98 = 6{,}390.$$

Reproduction and Development.—The congress of this interesting little species has never been described, but the eggs have been observed from August quite up to January; they are oval in shape, and very large for the size of the animal, being two mill. long and one-and-half mill. broad or even of a larger size, gelatinous to the touch, semitransparent and pearly-white in colour, with opaline reflections. They have been observed to be deposited in irregular clusters strongly cemented together with a yellowish mucus, but not exceeding twenty in a cluster.

The eggs hatch in about three weeks after deposition, the young when hatched may be, according to Dr. Scharff, light red, with violet tentacles, gradually changing however until by the time they have attained eight mill. in length they have become pale grey, a colour due to the viscera showing through the semitransparent skin, the head becomes also of a delicate grey, and no bands are perceptible on body or mantle.

Mr. Gain, whose studies of the development, food, and habits of the slugs have been so complete and valuable, records that the young are usually dark green or yellow, and that the change in adult life is to a paler coloration. Some of the green variety, obtained early in April, only increased slightly in bulk during the following six weeks, but changed to a greenish yellow with a perceptible slaty-grey lateral band on each side; early in June they had increased materially in size, lost all trace of green, and were quite yellow, with well-marked lateral band, and dusky mid-dorsal line; they gradually became paler and almost white, except the sole and caudal gland, which were of a deeper colour, while the lateral and dorsal banding became fainter and more diffuse; towards the end of July the animals attained maturity and their final coloration, from which time onwards into January the adults and their egg-clusters have been found, but the animals do not appear to survive much beyond that period.

Food and Habits.—*Arion intermedius* is described as naturally purely fungivorous, and in Germany is confined to the moss on pine-covered heathy land. In this country it is found chiefly on the various species of *Russula*, *Agaricus* and *Clavaria*, but in captivity it is not nearly so restricted in its diet, eating lettuce freely, and also readily devouring cabbage, watercress, bread, and even paper. Brevière records that it feeds eagerly upon dead or moribund worms and small animals.

It is not a garden species, nor does it usually frequent cultivated ground, but seems to prefer living in the open country, hiding beneath animal and other refuse, possibly on account of the fungoid growths thereon, they are also found in grass-fields where fungi abound, or on the margin of woods, concealed beneath dead leaves, close by the small fungi which grow in clusters at the foot of the trunks of old trees, and to which the animal approximates so closely in colour, that it has been likened to a small fungus just peeping above the ground.

When at rest, the animal assumes the hemispherical shape, which is so characteristic of *Arion ater*, and in this position the remarkable crested tubercles of the body are most apparent. It is fond of burrowing in the earth, where it lies concealed during dry weather, and is also addicted to a peculiar habit of raising aloft the anterior part of its body and apparently looking around, like a stoat, a habit to which *L. arborum* is also addicted.

In captivity, the skin soon becomes uniformly distended, and the rugosities effaced, but if kept in somewhat dry surroundings it very quickly becomes sickly and perishes, shrinking up especially posteriorly, but also showing a very peculiar constriction near the middle of the body.

Parasites.—This species is at times infested with a tiny *Acarus* of a white colour, which in size, general aspect, and activity resembles the ordinary *Acarus* of our larger slugs.

Variation.—The variability of this species is not great, but it is suggestive that in the south-west corner of Ireland the specimens generally are much darker coloured and more strongly banded than those found in England. How far this may be an effect of the moister climate, and how much may be attributed to their retention of the darker colouring said by Mr. Gain to be a characteristic of the earlier stages of life in England, is uncertain, but it is worthy of note that this most general retention of immature colouring should be in stations furthest removed from the most active evolutionary centre and where the last remaining stronghold of *Geomalacus* is located.

VARIATIONS IN COLOUR AND MARKINGS OF ANIMAL

Var. **alba** Taylor.

ANIMAL almost pure white.

ENGLAND AND WALES.

Cambridge—Grantchester, Sept. 1904 ! Hugh Watson.
Carmarthen—Near Llanelly, Sept. 1904 ! H. Rowland Wakefield.

IRELAND.

Dublin—Ditch, Foxhall Demesne, Raheny ; and Killakee, Dublin Mountains, Sept. 1890 ! R. F. Scharff.
Galway W.—Renvyle and Kylemore, March 1891, R. F. Scharff.

Var. **normalis** Moquin-Tandon, Hist. Moll. France, 1855, p. 16.

Arion flavus var. *normalis* Moquin-Tandon, l.c.

ANIMAL yellow, with blackish head and tentacles.

IRELAND.

Antrim—Belfast, Dec. 1891, R. F. Scharff.
Clare—Woodpark, Scariff, Sept. 1904 ! N. F. Hibbert.
Kerry—Great Skellig (R. F. Scharff, Irish Nat., Jan. 1898, p. 11).

CONTINENTAL DISTRIBUTION.

France—Pas de Calais (Bouchard-Chantereux, Moll. Pas de Calais, 1838, p. 23).

Var. **pallida** Moquin-Tandon, Hist. Moll. France, 1855, p. 16.

Arion flavus var. *pallidus* Moquin-Tandon, l.c.
Arion flavus var. *albidus* Moquin-Tandon, l.c.

ANIMAL pale, back pale cinereous, with yellow or orange shield.

The sub-var. **albida** is whitish, yellowish beneath and also on the shield, head and tentacles blackish.

ENGLAND.

Cornwall E.—Stenalee, St. Austell, Sept. 1904 ! C. P. Richards.
Devon N.—Belstone, Okehampton Sept. 1904 ! Miss Daisy Mason.

IRELAND.

Roscommon—Mote Park, Sept. 1904 ! Lord Crofton.
Leitrim—Drumkeeran, Oct. 1904 ! Rev. J. Meehan.
Waterford—Clonmel, Rev. A. H. Delap.

CONTINENTAL DISTRIBUTION.

France—V. *pallida* and sub-v. *albida*, Pas de Calais (Bouchard-Chantereux, l.c.).

Var. **plumbea** Collinge, Conch., ii., 1892, p. 63.

ANIMAL dark-grey ; shield and tail only slightly tinged with orange ; foot-sole cream, somewhat darker medially.

This is the var. *grisea* of Roebuck.

ENGLAND AND WALES.

Cornwall E.—Stenalee, St. Austell, Sept. 1904 ! C. P. Richards.
Devon N.—Belstone near Okehampton, Sept. 1904 ! Miss Daisy Mason.
Suffolk E.—Mendlesham, Oct. 1904 ! A. Mayfield.
Norfolk W.—Didlington Hall, Sept. 1904 ! Hon. Mrs. Evelyn Cecil.
Northampton—Kettering, Sept. 1904 ! C. E. Wright.
Gloucester W.—Symonds Yat, Sept. 1904 ! W. C. Blake.
Hereford—Garden, Acacia Villa, Ross, Sept. 1904 ! W. C. Blake.

Brecon—Garden, Llaneglıw fawr, Sep. 1904 ! and Erwood, Aug. 1904 ! J. Williams Vaughan.

Carmarthen—Near Llanelly, Sept. 1904 ! H. Rowland Wakefield. Golden Hill, Sept. 1904 ! Lady Lyons.

Cardigan—Borth, Sept. 1904 ! Hugh Watson.

Lincoln N.—Amongst needles of Scotch fir, Linwood, Sept. 1904 ! Rev. E. A. Woodruffe-Peacock.

Notts.—Newark, W. A. Gain (W. E. Collinge, l.c.).

SCOTLAND.

Lanark—Blackwood Estate, Kirkmuirhill, Sept. 1904 ! N. B. Kinnear.

Peebles—Cowes Linn, Sept. 1904 ! W. Evans.

Kincardine—Near Aberdeen, Sept. 1904 ! G. Sim.

Aberdeen S.—Garden, Rubislaw, Oct. 1904 ! G. Sim.

IRELAND

Antrim—Ballycastle, Oct. 1904 ! Miss F. S. O'Connor.

Armagh—Portadown, Oct. 1904 ! W. A. Green.

Monaghan—Drumreaske, Sept. 1904 ! W. F. de Vismes Kane.

Louth—Beaulieu near Drogheda, Oct. 1904 ! P. H. Grierson.

Dublin—A pale grey form, Carrickmines, April 1892, R. F. Scharff.

Kildare—Dark and pale grey forms, Maynooth, Nov. 1891, R. F. Scharff.

Queen's Co.—Stradbally, Sept. 1904 ! A. G. Stuart.

Roscommon—Mote Park, Sept. 1904 ! Lord Crofton.

Galway W.—Connemara, R. F. Scharff (W. E. Collinge, l.c.).

Kerry—Lough Caragh, Rev. A. H. Delap (Scharff, Slugs of Ireland, 1891, p. 550). Cromaghlaun Mountain, Sept. 1898, Lionel E. Adams.

CONTINENTAL DISTRIBUTION.

France—Pas de Calais (Bouchard-Chantereux, op. cit.).

Var. **appenina** Pollonera, Nuov. Contr., 1889, p. 18, ff. 11, 12.

Arion mollerii Pollonera, op. cit., p. 18, ff. 7-10.

ANIMAL pale, with well-defined black bands.

The **Arion mollerii** may be ranged with the var. *appenina*, differing chiefly in the dorsum being a yellowish-flesh colour, and the shield punctate with black.

IRELAND.

Kerry—Stubbs and Adams' record (Irish Nat., 1898, p. 261) that the examples from the south-west corner of Ireland are darker and more strongly banded than British specimens; they are probably referable to the sub-var. *mollerii*.

CONTINENTAL DISTRIBUTION.

Italy—Lucca, Tuscany (Pollonera, l.c.).

Portugal—Sub-var. *mollerii*, Busaco (Pollonera, l.c.).

Var. **brunnea** Taylor.

ANIMAL maroon-brown, with side-bands of a still darker brown.

ENGLAND.

Cornwall E.—St. Austell, Sept. 1904 ! C. P. Richards.

Geographical Distribution.—The area inhabited by this very ancient species is doubtless more extensive than that of any of its congeners, but is as yet very inadequately known, as this *Arion* has been, and is still, so often passed over or mistaken for a pale variety of *Arion hortensis* or the young state of *A. ater*, even by experienced conchologists, before its specific peculiarities have been pointed out. In fact, our knowledge of the distribution of the whole of the species of the genus *Arion* is in a very confused and unsatisfactory condition, owing chiefly to the neglect of the group by most conchologists, and the lamentable ignorance on the subject which so generally prevails.

Arion intermedius has, however, been reported from Great Britain, Germany, France, North Italy, Switzerland, Russia, Scandinavia, Portugal, and the Azores.

It is also plentiful in or near gardens in certain parts of New Zealand, from whence it was first reported by Capt. Hutton as *Arion incommodus*.

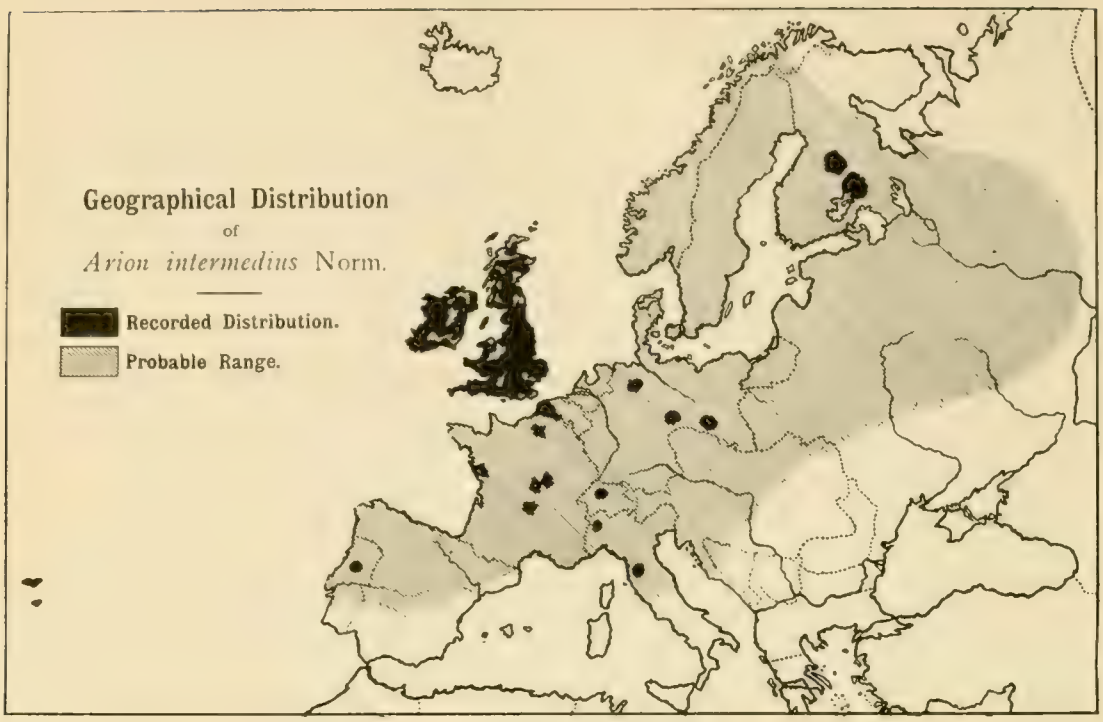


Fig. 250.

ENGLAND AND WALES. *PENINSULA.*

Cornwall W.—Truro, 1904, C. E. Wright and L. E. Adams.

Cornwall E.—Type and vars. *brunnea*, *plumbea*, and *pallida*, Stenalee, St. Austell, Sept. 1904 ! C. P. Richards.

Devon S.—Muttley near Plymouth ; Totnes and Credy Park, near Exeter, E. J. Lowe, 1888. Axminster ; Exmouth ; Countesbury ; Topsham and Culverhole Point, Aug. 1892 ! Lionel E. Adams and Charles Oldham.

Devon N.—Westward Ho, E. J. Lowe, 1888. Vars. *plumbea* and *pallida*, Belstone, Okehampton, Sept. 1904 ! Miss Daisy Mason.

Somerset S.—Taunton, E. J. Lowe, 1888. Common at Porlock, Minehead, and Watchet, Aug. 1892 ! Lionel E. Adams.

Somerset N.—Clevedon, Minehead, and Bath, E. J. Lowe, 1888.

CHANNEL.

Wilts. S.—Dinton near Salisbury, Sept. 1905 ! Hugh Wyndham.

Dorset—Abbotsbury and Portland, Aug. 1892, Lionel E. Adams.

Hants. S.—Abundant in Crabbe Wood and other woods near Winchester, Aug. 1894, Lionel E. Adams. Buriton, Aug. 1902, H. Wallis Kew. Hedges around the Pheasantries, Hambledon, May 1904 ! C. S. Coles.

Hants. N.—Liphook, July 1905, Rev. S. Spencer Pearce.

Sussex W.—Near Liphook, July 1905, Rev. S. Spencer Pearce.

THAMES.

Kent W.—Chislehurst, May 1885 ! T. D. A. Cockerell. Moderately common about Canterbury, Sept. 1895, Lionel E. Adams.

Surrey—In woods on the chalk-hills, Reigate, Sept. 1902, Lionel E. Adams Grayswood, E. W. Swanton (C. Pannell, jr., J. of Conch., Apr. 1902, p. 169).

Essex S.—Common with *Limax tenellus* at Loughton in Epping Forest, on *Russula vesca*, *R. fellea*, *R. cyanoxantha*, *Collybia maculata*, *Lactarius blennius*, and *L. vellereus*, Oct. 1904 ! T. Petch.

Middlesex—Churchyard Bottom Wood, Highgate, April 1892 ! H. Wallis Kew.

Berks.—Wytham Hill, Rev. S. Spencer Pearce.

Oxford—Under dead leaves and beech logs, Blenheim Park, July 1904 ! Rev. S. Spencer Pearce. *A. flavus*, beech woods, Oxford (Norman, Zool., 1852. p. 4126).

Bucks.—Olney Churchyard, Oct. 1893 ! Lionel E. Adams. Burnham Beeches, Oct. 1905, H. Wallis Kew.

ANGLIA.

Suffolk E.—Mendlesham ; Brockford and Thwaite (A. Mayfield, J. of Conch., 1903, p. 295). Type and var. *plumbea*, Mendlesham, Oct. 1904 ! A. Mayfield.

Suffolk W.—Drinkstone, Sept. 1903 ! and Whepstead, Sept. 1904 ! A. Mayfield.

Norfolk E.—Under dead leaves, Caistor, Nov. 1894 ! St. Edmund's; Dunston and Buckenham, 1896, A. Mayfield. Near Norwich, E. J. Lowe, 1888.

Norfolk W.—Type and var. *plumbea*, Didlington Hall, Sept. 1904 ! Hon. Mrs. Evelyn Cecil.

Cambridge—Var. *alba*, Grantchester, Sept. 1904 ! Hugh Watson.

Northampton—Yardley Chase, March 1893 ! Lionel E. Adams. Haselbeech, Sept. 1904, Rev. W. A. Shaw. Var. *plumbea*, Kettering, Sept. 1904 ! C. E. Wright.

SEVERN.

Gloucester W.—Sharpness, E. J. Lowe, 1885. Var. *plumbea*, Symonds Yat, Sept. 1904 ! W. C. Blake.

Monmouth—Abundant, Shirenewton near Chepstow, 1888 ! E. J. Lowe.

Hereford—Var. *plumbea*, Acacia Villa, Ross, Sept. 1904 ! W. C. Blake.

Worcester—Worcester, E. J. Lowe, 1888. Selly Oak, Feb. 1893 ! C. Oldham.

Warwick—Solihull, Feb. 1893 ! L. E. Adams. Common in marshy ground, Sutton Park, Feb. 1903, H. Overton. Wood near Shirley, Sept. 1904 ! J. Madison.

Stafford—Moderately common about Stafford ; Manifold Valley, May 1889 ! Lionel E. Adams. Newton road, Birmingham, July 1893 ! Charles Oldham.

SOUTH WALES.

Glamorgan—Cardiff, E. J. Lowe, 1885.

Brecon—Gwenddwr Grouse Moor near Blaenau, alt. 1,200 feet, Sept. 1904 ! var. *plumbea*, near Erwood, Aug. 1904 ! J. Williams Vaughan.

Radnor—Erwood, Aug. 1904 ! J. Williams Vaughan.

Carmarthen—Type and var. *plumbea*, Golden Hill, Sept. 1904 ! Lady Lyons. Vars. *alba* and *plumbea*, near Llanelly, Sept. 1904 ! H. Rowland Wakefield.

Pembroke—Near Pembroke, June 1885 ! Mrs. Trayler. Not uncommon in a plantation in Heywood lane, Tenby, and elsewhere, A. G. Stubbs.

Cardigan—Var. *plumbea*, Borth, Sept. 1904 ! Hugh Watson.

NORTH WALES.

Merioneth—Nant-y-Mor, June 1901 ! W. Denison Roebuck.

Carnarvon—Bettwys-y-Coed, May 1898 ! Charles Oldham.

TRENT.

Lincoln S.—Old quarry, Great Ponton, Aug. 1902 ! R. Worsdale.

Lincoln N.—In fields, Harrington ; and roadsides, Bag Enderby ; also Burwell Woods ! and Grisel Bottom, Sept. 1889 ! W. Denison Roebuck. Calceby near Alford, Nov. 1889 ! J. Burtt Davy. Blow Wells, Tetney, April 1903 ! H. W. Kew. Claxby, April 1903 ! Rev. A. E. Woodruffe-Peacock.

Leicester and Rutland—Farlesthorpe, May 1887 ! J. E. Mason. Glenfield and Groby Pool near Leicester, July 1892 ! Charles Oldham.

Notts.—Gamston ! and Felley Abbey, Sept. 1884 ! C. T. Musson. Common, Southwell, Sept. 1892 ! Charles Oldham. In woods, Tuxford, and other places, 1893, W. A. Gain. Staunton-on-the-Wolds, E. J. Lowe, 1885.

Derby—Clifton near Ashbourne, May 1890, L. E. Adams. Buxton, July 1892 ! C. Oldham. Chatsworth, E. J. Lowe, 1885. Miller's Dale, Oct. 1904 ! R. Welch.

MERSEY.

Cheshire—Ringway near Bowden ! and Marple, May 1892! also Baguley Hall, Sep. 1892 ! Charles Oldham. Romiley, Sep. 1895, Lionel E. Adams. Var. *plumbea*, Peover near Knutsford, Aug. 1885 ! J. G. Milne.

Lancashire S.—Southport, E. J. Lowe, 1888.

Lancashire Mid—Chaigeley Manor, Clitheroe, and Lancaster, E. J. Lowe, 1888.

HUMBER.

York S.E.—Brough, May 1901 ! J. E. Crowther. Sledmere, Aug. 1891 ! and Withernsea, Aug. 1892 ! F. W. Fierke. Driffield, June 1902 ! Rev. E. Percy Blackburn.

York N.E.—Whitby, E. J. Lowe, 1888. Kirkleatham, Sept. 1886 ! Saltburn Wood ! and near Carlinhow Station, Oct. 1886 ! also Beedale near Scarborough, June 1901 ! and Harwood Dale, May 1904 ! W. Denison Roebuck. Hayburn Wyke, Aug. 1894 ! F. W. Fierke.

York S.W.—Cusworth, Sept. 1886 ! Birkenshaw, Sept. 1888 ! and Hebden Bridge, June 1904 ! W. Denison Roebuck. Common about Penistone, May 1891 ! and abundant in Gunthwaite Wood, Oct. 1892 ! Lionel E. Adams. Near Worsborough Reservoir, Sept. 1899 ! W. E. Brady. Park Wood, Elland, J. E. Crowther.

York Mid W.—Lister Park, Bradford, on a species of *Clavaria*, Sept. 1890, R. F. Scharff. Common in Shipley Glen, and on canal banks, Steeton, May 1900 ! also Grassington, Sep. 1900 ! and in a damp spot, Frizinghall, Sep. 1904 ! F. Rhodes. Bolton Abbey Woods, Sept. 1890 ! R. F. Scharff. Ribblehead and Horton-in-

Ribblesdale, May 1892 ! also near waterfall, Crook Gill, Buckden, and on slopes of Buckden Pike, Aug. 1904 ! W. Denison Roebuck.

York N.W.—Rokeby, June 1892 ! W. Nelson. Sedbergh ! and Cowgill, Denthead, Sept. 1904 ! W. Denison Roebuck.

TYNE.

Durham—High Force, Teesdale, and Barnard Castle, E. J. Lowe, 1888.

Northumberland—*Arion flavus* recorded by Alder from Haltwhistle, and by Forbes and Hanley from roadside, Westgate Hill (Forbes and Hanley, Brit. Moll., iv., p. 9). Ditch, Kenton near Newcastle, Sept. 1904 ! Mrs. B. J. Willans.

LAKES.

Westmorland and Lake Lancashire — Windermere; Coniston, and base of Helvelyn, E. J. Lowe, 1888.

Cumberland—Silloth, and Corby Castle nr. Carlisle, E. J. Lowe, 1888. Keswick, July 1903 ! Rev. R. Godfrey.

Isle of Man—Douglas, Apr. 1904 (B. R. Lucas, J. of Conch., July 1904, p. 90).

SCOTLAND.

WEST LOWLANDS.

Dumfries—Moffat, Jan. 1891 ! W. Evans.

Ayr—Coast near Skelmorlie, Aug. 1886 ! W. Denison Roebuck. Girvan, Sept. 1890 ! W. Evans. Seamill; West Kilbride; Gill; Portincross and Fairlie, 1903, Rev. R. Godfrey.

Lanark—Lanark, E. J. Lowe, 1888. Var. *plumbea*, Blackwood estate, Kirkmuirhill, Sept. 1904 ! N. B. Kinnear.

EAST LOWLANDS.

Peebles—Leadburn, Mch. 1894 ! v. *plumbea*, Cowes Linn, Sep. 1904 ! W. Evans.

Selkirk—Tushielaw, July 1892 ! W. Evans.

Berwick—Roadside, Cowdenknowes, Aug. 1886 ! Eyemouth, Sep. 1895 ! W. Evans.

Haddington—Westbarns near Dunbar, Sept. 1894 ! Winton, July 1895 ! Longniddry, Feb. 1896 ! and Yester, Sept. 1896 ! W. Evans.

Edinburgh—Bonally ! and Lothianburn, Oct. 1890 ! Penicuik Woods ! and Rosslyn Glen, Oct. 1896 ! Vogrie Glen, Feb. 1897; and Armiston Glen, June, 1902, W. Evans.

Linlithgow—South Queensferry, Aug. 1886 ! W. Denison Roebuck. Carribber Glen, Feb. 1898; Bonytown Hills, Aug. 1901; and Dalmeny, Oct. 1902 ! W. Evans. Universally distributed throughout the county: I have found it at Blackness; Preston; Livingston; Linlithgow Loch; near Winchburgh; Dyke Nook; Kinneil Hill and Woods; Avontown; Linlithgow Bridge; Muirhouses; Graeme's Dyke; Bowmains; and other places, Rev. R. Godfrey, 1902.

EAST HIGHLANDS.

Fife and Kinross—Edenfield near Cupar, E. J. Lowe, 1888. Kilconquhar, Sept. 1893; Loch Leven, June 1894; Aberdour, April 1893; Loch Gelly, May 1895; Falkland, Aug. 1895; and Charlestown, Feb. 1896, W. Evans.

Stirling—Duchray, May 1896 ! W. Evans.

Perth S. and Clackmannan—Callander, April 1892 ! Aberfoyle and Dollar, May 1897; Isle of May, Sept. 1897; and Bridge of Allan, Feb. 1898, W. Evans.

Perth Mid—Ben Lawers, E. J. Lowe, 1888. Near Kenmore, May 1892 ! W. Evans. Glen Ogle, Lochearnhead, June 1894 ! Rev. R. Godfrey.

Kincardine—Banchory, Sep. 1904 ! and var. *plumbea*, near Aberdeen, Sep. 1904 ! G. Sim.

Aberdeen S.—Type and var. *plumbea*, garden, Rubislaw, Oct. 1904 ! G. Sim.

Banff—Banks of Avon, Ballindalloch, Sept. 1891 ! W. Evans. Aberlour, Nov. 1892 ! Lionel Hinxman.

Elgin—Gardens, Elgin, Dec. 1890 ! Rev. Geo. Gordon. Grantown ! and Castle Roy near Netley Bridge, Aug. 1891; also Cromdale, Sept. 1891 ! W. Evans.

Easterness—Dalwhinnie, at an alt. of 1,200 feet, June 1892 ! W. Evans. Pine forest of Rothiemurchus, Aug. 1904 ! Rev. R. Godfrey.

WEST HIGHLANDS.

Main Argyle—Dunoon, Aug. 1886 ! W. Denison Roebuck. Crinan, Dec. 1886 ! Rev. J. E. Somerville. Common at Barbreck, June 1900; found also at Sonachan; Dunollie; Glen Crutten; and Lochan Dubh near Oban, July 1901, Rev. R. Godfrey.

Clyde Isles—Margins of Loch Greenan, Isle of Bute, Aug. 1886 ! W. Denison Roebuck. Brodick, Isle of Arran, April 1895 ! W. Evans.

NORTH HIGHLANDS.

Sutherland E.—Garden, Brora, Oct. 1892 ! W. Baillie.

NORTH ISLES.

Hebrides—Fairly common and varying greatly in size on the Island of Hirta, one of the St. Kilda group, July 1905 ! J. Waterston.

Orkneys—Harray, Dec. 1890 ! W. Evans.

IRELAND.

ULSTER.

Antrim—In the dark part of wood at Murlough, and near Glenshesk, Sept. 1896 (R. Standen, Irish Nat., Jan. 1897). Common on Rathlin Island, and about Ballycastle and Murlough, May 1897, L. E. Adams. Cave Hill, Belfast, 1893; Conagher Farm, and Derrykeighan Old Church, Dervock, Feb. 1898; Kenbane, Oct. 1898; not common, Brown's Bay, July 1899; and Glencorp, Cushendall, March 1900, R. Welch. Var. *plumbea*, Ballycastle, Oct. 1904 ! Miss F. S. O'Connor. Var. *normalis*, Belfast, Dec. 1891, R. F. Scharff.

Down—Near Newry, 1904, P. H. Grierson. About source of river Bann, near Deers Meadow, Mourne Mountains, at an alt. of 1,100 feet, Jan. 1898; Ardglass, rare, Dec. 1898; Newcastle, June 1898; rare on banks of Clandeboye Lake, May 1899; Dundrum, Nov. 1899; moderately common, Belvoir Park, May 1898; Hillsborough, April 1899, R. Welch; common and large on the margins of woods at Helen's Bay, Sept. 1904, A. W. Stelfox and R. Welch.

Armagh—Acton Glebe, Poyntzpass, Sept. 1904 ! Rev. W. F. Johnson. Portadown, Oct. 1904 ! W. A. Green.

Monaghan—Glaslough Demesne, Nov. 1897, R. Welch. Type and var. *plumbea*, Drumreaske, Sept. 1904 ! W. F. de V. Kane.

Tyrone—Baronscourt, Sept. 1904 ! R. Bell.

Donegal—Very rare, Rosapenna, Oct. 1904, R. Welch.

LEINSTER.

Louth—Near Blackhall Demesne ! and about Collon, Sept. 1904 ! also type and var. *plumbea*, Beaulieu near Drogheda, Oct. 1904 ! P. H. Grierson.

Meath—Nobber, July 1904 ! P. H. Grierson.

Dublin—Rare at the Marsh, Bushy Park, Sep. 1903 (R. Welch and A. W. Stelfox, Irish Nat., June 1904, p. 123). Abundant in a field at Raheny, and var. *alba* in ditch, Foxhall Demesne, Raheny, Sept. 1890 ! type and var. *alba* also common at Killakee, all on fungi, chiefly species of *Russula*, Sept. 1890; and var. *plumbea*, Carrickmines, April 1892, R. F. Scharff.

Kildare—Lyns, Aug. 1904 ! P. H. Grierson. Var. *plumbea*, Maynooth, Nov. 1891, R. F. Scharff.

Wicklow—Common in the Earl of Meath's Demesne, Kilruddery, Sept. 1890, and also found in field near Greystones, and in the Glen of the Downs, July 1891, and Woodenbridge, Meh. 1893, R. F. Scharff. Powerscourt, Apl. 1904 ! P. H. Grierson.

Carlow—Fenagh House, Bagenalstown, Sept. 1904 ! Denis R. Pack-Beresford.

Queen's Co.—Type and var. *plumbea*, Stradbally, Sept. 1904 ! A. G. Stuart.

CONNAUGHT.

Roscommon—Lough Glynn, Castlereagh, Oct. 1904 ! Hugh Kennedy. Type, with vars. *plumbea* and *pallida*, Mote Park, Sept. 1904 ! Lord Crofton.

Leitrim—Near Cloone, Dec. 1899 ! P. H. Grierson. Var. *pallida*, Drumkeeran, Oct. 1904 ! Rev. J. Meehan.

Sligo—On low grassy bank near seashore, Carrahubbuck, Oct. 1892 ! Miss Amy Warren. Sligo, July 1904 ! A. W. Stelfox.

Mayo E.—Manulla Junction, Sept. 1904 ! W. West.

Mayo W.—Moyne Abbey, June 1891 ! Miss Amy Warren.

Galway W.—Vars. *plumbea* and *alba*, about Renvyle and Kylemore, March 1891, R. F. Scharff. Near Clifden, Sept. 1904 ! W. West.

Galway E.—Clonbrock, Sept. 1904 ! Hon. R. E. Dillon.

MUNSTER.

Clare—Var. *normalis*, Woodpark, Scariff, Sept. 1904 ! N. F. Hibbert.

Tipperary N.—Shores of Lough Derg, Sept. 1904 ! G. J. Fogerty.

Waterford—Var. *pallida*, near Clonmel, Rev. A. H. Delap.

Cork S.—Common at Bantry, Sept. 1898, Lionel E. Adams.

Kerry—Derrycunihy Wood, Killarney, May 1898, R. Welch. Not uncommon in Kenmare Demesne, and in wood on the road to Glengariff, also found at Loo Bridge, Mucksna Wood, Sheen Wood, and at Galway's Bridge, Killarney (R. Standen, Irish Nat., Sept. 1898). Valentia Island, Sept. 1904 ! Miss M. J. Delap. Var. *plumbea*, Lough Caragh, Sept. 1890, Rev. A. H. Delap; and Cromaghlaun Mountain, Sept. 1898, L. E. Adams. Var. *normalis*, Great Skellig (R. F. Scharff, Irish Nat., Jan. 1898, p. 11).

GERMANY.

Recorded by Simroth from Lower Lusatia, the Harth near Leipzig in Saxony, and from Vegesack near Bremen.

FRANCE.

Only recorded as yet from the Nord; as *Arion flavus* from the Pas-de-Calais; as *A. mabillianus* and *A. verrucosus* from the Oise; as *A. verrucosus* from Nièvre and Puy-de-Dôme; as *Geomalacus hiemalis* from Côte d'Or; and as *G. vendeanus* from the Vendeé.

SWITZERLAND.

Recorded by Simroth from Mount Pilatus in Canton Lucerne.

ITALY.

Found up to the present in Piedmont, and the var. *appenina* at Lucca in Tuscany.

AUSTRO-HUNGARY.

Clessin regards this as a probable inhabitant of the higher lands of the Tyrol.

PORTUGAL.

Arion möllerii is recorded from Busaco in the province of Beira by Pollonera.

SCANDINAVIA.

Recorded for Scandinavia by Dr. Scharff (Slugs of Ireland, 1891, p. 551).

RUSSIA.

Only as yet recorded from Finland, where, according to Luther, it is found as far north as 64° north latitude.

ATLANTIC ISLES.

Azores—San Miguel, an undoubted native, but found only on Pico de Carvao and in the Valley of Furnas, far removed from cultivated ground.

AUSTRALASIAN REGION.

New Zealand—Recorded by Mr. Musson under the name of *Arion hortensis* as plentiful about Auckland crawling on the roads after rain. Abundant under timber by garden at Manawapouri Lake; also found at Paradise on the shores of Diamond Lake; it is a garden slug here, Feb. 1905, W. Denison Roebuck.

Fig. 251.—Helen's Bay, Co. Down, Ireland, where *Arion intermedius* is plentiful and of large size, under decaying logs and other shelter (photo. by Mr. R. Welch).

Distribution of *A. intermedius* Normand

In the Counties and Vice-Counties of the British Isles.

ENGLAND AND WALES.

Channel Isles

PENINSULA
1 Cornwall W.
2 Cornwall E.
3 Devon S.
4 Devon N.
5 Somerset S.
6 Somerset N.

CHANNEL
7 Wilts N.
8 Wilts S.
9 Dorset
10 Isle of Wight
11 Hants S.
12 Hants N.
13 Sussex W.
14 Sussex E.

THAMES
15 Kent E.
16 Kent W.
17 Surrey
18 Essex S.
19 Essex N.
20 Herts.
21 Middlesex
22 Berks.
23 Oxford
24 Bucks.

ANGLIA
25 Suffolk E.
26 Suffolk W.
27 Norfolk E.
28 Norfolk W.
29 Cambridge
30 Bedford
31 Hunts.
32 Northampton

SEVERN
33 Gloucester E.
34 Gloucester W.
35 Monmouth
36 Hereford
37 Worcester
38 Warwick
39 Stafford
40 Salop

SOUTH WALES
41 Glamorgan
42 Brecon
43 Radnor
44 Carmarthen
45 Pembroke
46 Cardigan

NORTH WALES
47 Montgomery
48 Merioneth
49 Carnarvon
50 Denbigh
51 Flint
52 Anglesey

TRENT
53 Lincoln S.
54 Lincoln N.
55 Leic. & Rutld.
56 Notts.
57 Derby

MERSEY
58 Cheshire
59 Lancashire S.
60 Lan'shire Mid

HUMBER
61 S.E. York
62 N.E. York
63 S.W. York
64 Mid W. York
65 N.W. York

TYNE
66 Durham
67 Northumb. S.
68 Cheviotland

LAKES
69 Westmorland and L. Lanes.
70 Cumberland
71 Isle of Man

SCOTLAND.

W. LOWLANDS
72 Dumfries
73 Kirkcudbright
74 Wigtown
75 Ayr
76 Rentrew
77 Lanark

E. LOWLANDS
78 Peebles
79 Selkirk
80 Roxburgh
81 Berwick
82 Haddington
83 Edinburgh
84 Linlithgow

E. HIGHLANDS
85 Fife & Kinross
86 Stirling
87 Pth. S. & Clkn.
88 Mid Perth
89 Perth N.
90 Forfar
91 Kincardine
92 Aberdeen S.

E. HIGHLANDS
93 Aberdeen N.
94 Banff
95 Elgin
96 Easterness

W. HIGHLANDS
97 Westerness
98 Main Argyle
99 Dumbarton
100 Clyde Isles
101 Cantire
102 Ebudes S.
103 Ebudes Mid
104 Ebudes N.

N. HIGHLANDS
105 Ross W.
106 Ross E.
107 Sutherland E.
108 SutherlandW
109 Caithness

NORTH ISLES
110 Hebrides
111 Orkneys
112 Shetlands

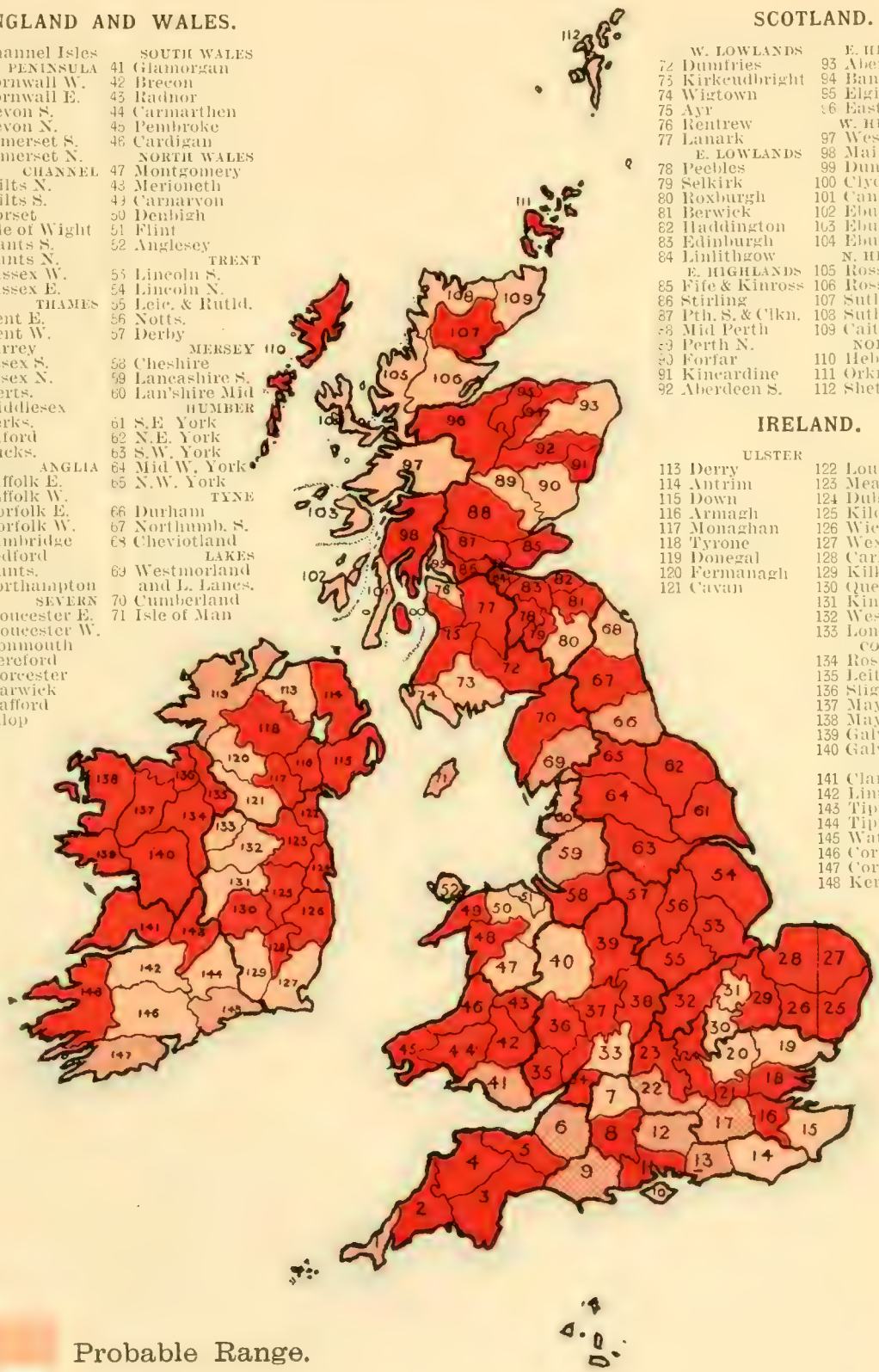
IRELAND.

ULSTER
113 Derry
114 Antrim
115 Down
116 Armagh
117 Monaghan
118 Tyrone
119 Donegal
120 Fermanagh
121 Cavan

LEINSTER
122 Louth
123 Meath
124 Dublin
125 Kildare
126 Wicklow
127 Wexford
128 Carlow
129 Kilkenny
130 Queen's Co.
131 King's Co.
132 Westmeath
133 Longford

CONNAUGHT
134 Roscommon
135 Leitrim
136 Sligo
137 Mayo E.
138 Mayo W.
139 Galway W.
140 Galway E.

MUNSTER
141 Clare
142 Limerick
143 Tipperary N.
144 Tipperary S.
145 Waterford
146 Cork N.
147 Cork S.
148 Kerry



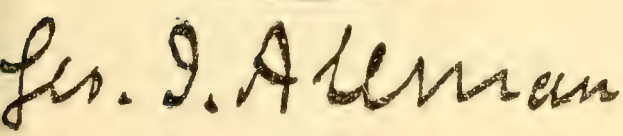
Probable Range.

Recorded Distribution.

Distribution verified by the Authors.

GENUS *GEOMALACUS* Allman.

(Geomalacus, Allman, Athenæum, 1842, p. 851).



THE genus *Geomalacus* (γη, the earth; μαλαχός, mollusk) is dedicated to the late Prof. G. J. Allman, who instituted the group and clearly defined the distinguishing features of its external morphology.

The genus has been subdivided by continental authors, and the subgenera *Letourneauxia* and *Arrudia* established for the species inhabiting North-western Africa and the southern parts of Spain and Portugal, which are distinguished by their internal organization approximating more closely to that of *Arion*, and externally by possessing distinct and dark lateral banding in adult life, a feature especially characteristic of and restricted to early life in the animals of the typical genus.

This dermal pigmentation is believed to promote cutaneous respiration,[1] and in its position to be essentially dependent upon and to indicate the course of the blood.

Generic Characteristics. — EXTERNALLY, *Geomalacus* has a subcylindrically limaciform and non-carinate BODY, with a bluntly-rounded caudal extremity; MANTLE or shield granulose, about one-third of the total length of the animal when extended, with the ample RESPIRATORY ORIFICE placed on the right margin of the shield and near the anterior third of its length; in the young, however, the respiratory orifice is quite median or even behind the centre, but as the growth of the shield proceeds more quickly behind than in front, the aperture becomes anterior by the time full growth has been attained; GENITAL ORIFICE near to and below the right ommatophore; CAUDAL GLAND opening transversely between the foot and the body; FOOT-SOLE indistinctly trifasciate, the median-area slightly darker and more transparent than the sides, and showing the muscular waves of extension and contraction during locomotion.

The SHELL is represented by an oval, flat and solid calcareous plate, placed beneath the shield and above the respiratory chamber.

INTERNALLY, the various species show a remarkable modification in the arrangement of the reproductive system, which exhibits an extraordinarily prolonged ATRIUM or vestibule, which functions as a male organ, while its retractor muscle is, according to the researches of Pilsbry, a totally distinct structure from that of *Arion*, and is affixed at the rear of the

1 Monog. i., p. 306.

body; the CEPHALIC RETRACTORS, though resembling those of *Arion*, have a longer pharyngeal muscle, which is basally fixed behind the right ommatophore. The RENAL ORGAN or kidney completely surrounds or encloses the heart, which is, therefore, centrally placed in regard to that organ, as in *Arion*.

Food and Habits.—The *Geomalaci* would appear naturally to subsist entirely upon the lichens and liverworts, but in captivity they will live and thrive on other and quite different food.

In their native habitat they are very perfectly protected by their mimetic resemblance to their surroundings, and by their nocturnal and crepuscular habits of life.

Fossil.—Fossil remains attributed to *Geomalacus* and named *pliocenicus* by Sacco, have been found in the Upper Pliocene beds of Fossana, Piedmont.

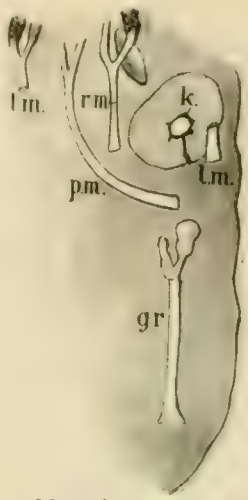
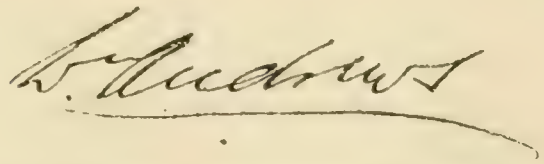


FIG. 253.—Muscular system of *Geomalacus* (after Simroth.)
g.r. genital retractor; *k.* kidney, enclosing heart; *l.m.* left tentacular retractor; *r.m.* right tentacular retractor; *p.m.* pharyngeal retractor.

Geographical Distribution.—The *Geomalaci* embrace but few species, and these are confined to the west of Europe, though allied sub-genera have been found in north-west Africa.

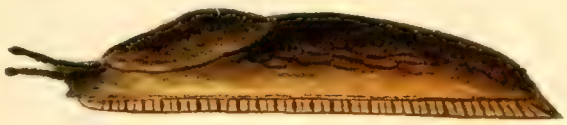
The geological evidence of the former extension of the group is as yet but slight, but the finding of remains referred to *Geomalacus* in the Upper Pliocene of Northern Italy leads us to infer that the genus had formerly a more eastern range, and it is probable that the evolutionary area of the genus was practically identical with that of *Arion* and the *Limacidæ* generally, but *Geomalacus* is evidently a decadent and waning group, and has by stress of competition with more dominant forms become restricted to the extreme west of Europe, a last foothold heralding their final extinction.

The genus *Anadenus* now expelled to the Himalayas is a closely-related but more primitive form than *Geomalacus*, but which on account of the easterly direction of its enforced migration, will probably outlive that group.

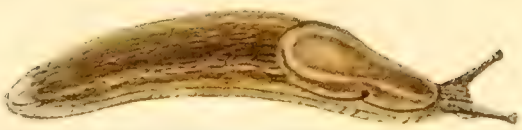


Autograph of Mr. W. Andrews, the discoverer of *Geomalacus maculosus*.

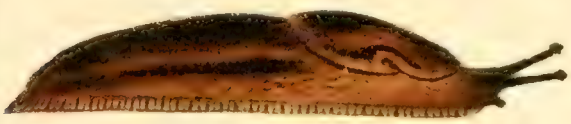
ARION AND GEOMALACUS.



1. *Arion subfuscus Drap., p.* 193.



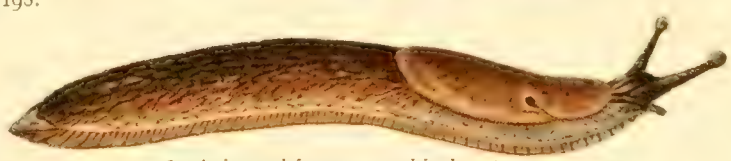
4. *Arion subfuscus var. ferussaci, p.* 201. (*after Férussac*).



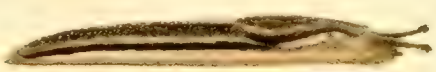
2. *Arion subfuscus var. rufo-fusca, p.* 198.

5. *Arion subfuscus var. aurantiaca, p.* 202.

3. *Arion subfuscus var. cinereo-fusca, p.* 200.

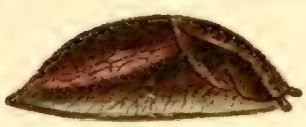


6. *Arion subfuscus var. bicolor, p.* 199. (*after Férussac*).

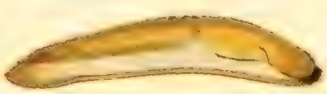


7. *Arion hortensis var. fasciata, p.* 215.

10. *Arion hortensis var. limbata, p.* 215.

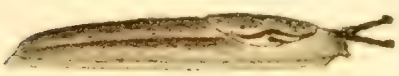


8. *Arion hortensis var. subfusca, p.* 217. (*after Simroth*).



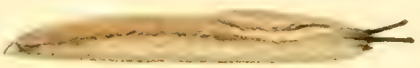
9. *Arion hortensis var. aurea, p.* 216. (*after Lessona*).

11. *Arion hortensis subvar. cottiana,* × 2, *p.* 215. (*after Polloneia*).



12. *Arion circumscriptus, p.* 227.

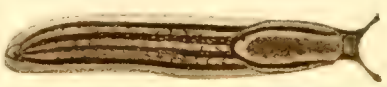
14. *Arion circumscriptus* (*field form*), *p.* 230. (*after Simroth*).



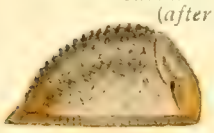
16. *Arion circumscriptus subvar. pallida, p.* 232.

13. *Arion circumscriptus var. neustriaca, p.* 232. (*after Férussac*).

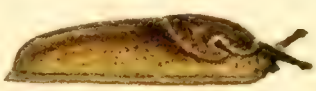
15. *Arion circumscriptus var. grisea, p.* 231. (*after Férussac*).



17. *Arion circumscriptus var. leucophæa, p.* 231. (*after Férussac*).



18. *Arion intermedius,* × 2, *p.* 240.



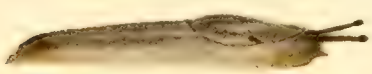
19. *Arion intermedius,* × 2. (*after Simroth*).

20. *Arion mollerii* (*enlarged*), *p.* 245.

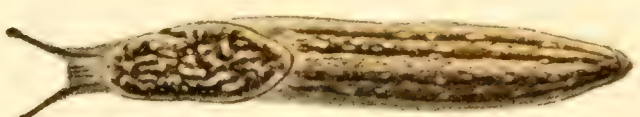
21. *Arion intermedius var. brunnea,* × 2, *p.* 245.

22. *Arion intermedius var. normalis, p.* 244.

25. *Geomalacus maculosus var. verkruzeni, p.* 259.

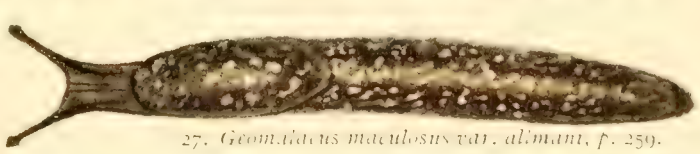


23. *Arion intermedius var. plumbea, p.* 245.



26. *Geomalacus maculosus var. fasciata, p.* 260.

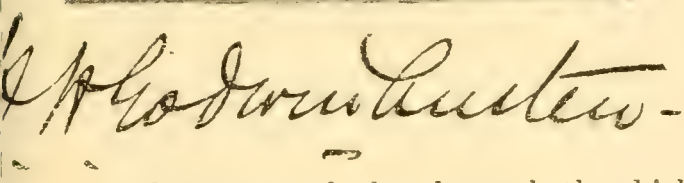
24. *Geomalacus maculosus, p.* 253. (*as coiled up in alarm*).



27. *Geomalacus maculosus var. alimani, p.* 259.

Geomalacus maculosus Allman.

1846 **Geomalacus maculosus** Allman, Ann. and Mag. N.H., xvii., p. 297, pl. 9, f. 1-3.
1867 — *andrewsi* Mabille, Rev. et Mag. Zool., p. 57.
1890 — *lusitanus* Pollonera, Boll. Mus. Zool., etc., p. 35.
1875 *Letourneauxia lusitana* da Silva e Castro, Moll. Terr. et Fluv. Portugal, p. 242.
1877 *Limax lusitanus* Morelet, Journ. de Conch., p. 259.



HISTORY.—*Geomalacus maculosus* (*maculosus*, spotted) was first discovered in the vicinity of Lough Caragh, Co. Kerry, Ireland, during the autumn of 1842, by the late Mr. W. Andrews, of Dublin, who, perceiving the interest and novelty of the animal, forwarded examples to Prof. G. J. Allman, who exhibited and described the new mollusk at the meeting of the Dublin Natural History Society in January, 1843.

With this interesting species, Lieut.-Col. H. H. Godwin-Austen, F.R.S., is associated, in appreciative expression of the merits of his masterly monograph of this species, published in his great work, "The Land Shells of India."

Diagnosis.—*Geomalacus maculosus* is the only species of the genus found in this country, and is at once separable from the several kinds of *Arion* by the possession of a solid, calcareous oval plate beneath the shield, by the position of the generative aperture near the base of the right ommatophore, somewhat as in *Limax*, and from all the *Limaces* by the presence of the caudal mucus gland and the anterior position of the respiratory orifice.

INTERNALLY, it is distinguishable by the exceedingly prolonged atrium, and the genital retractor muscle being attached only to the spermatheca and its stem, and not to the oviduct also, as in *Arion*.

Description—ANIMAL very extensible, and reaching to fifty-five mill. or more when adult, some very large specimens collected at Glengariff by Mr. A. W. Stelfox were nearly ninety mill. in length; the BODY is glossy, covered with about twenty-five longitudinal rows on each side of polygonal granulations; blackish or dark-grey

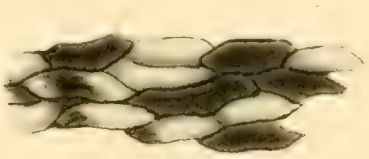


FIG. 256.

FIG. 257.

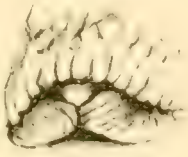


FIG. 258.

FIG. 256.—Dorsal rugæ of *Geomalacus maculosus*, showing their form and the arrangement of the pigmented areas, enlarged (after Heynemann).

FIG. 257.—Grooving of the hinder-part of foot of *Geomalacus maculosus*, enlarged (after Simroth).

FIG. 258.—Caudal end of the body of *Geomalacus maculosus*, showing the supra-pedal grooves and caudal gland, enlarged (after Godwin-Austen).

in colour, sometimes with indistinctly indicated darker subdorsal and lateral bands, which usually extend the whole length of the body, and are due to the body being overspread by numerous somewhat oval yellowish spots, which are, however, distributed more or less perceptibly in five longitudinal zones; SHIELD about one-third the length of the body when crawling, but only about half size when the animal is contracted, rounded in front and bluntly pointed behind, shagreened and spotted with somewhat similar but more uniformly distributed pale buff or whitish spots than those on the body; FOOT-FRINGE not very distinctly separated, very pale and somewhat expanded, with indistinct lineolation; SOLE pale dusky-ochreous, indistinctly trifasciate, with the mid-area somewhat darker and more transparent than the sides; CAUDAL GLAND triangular, not very conspicuous, opening transversely between the foot and the body, and often carrying a transparent yellowish ball of slime; UPPER TENTACLES smoky-black or grey, short and thick, but with oval extremities, and bearing the usual eye-specks at their summits; LOWER TENTACLES pale translucent grey.

DERMAL-MUCUS usually pale-yellow and variable in its degree of viscosity. LOCOMOTORY-MUCUS tenacious and usually colourless, but may be stained by the intermixture of the dermal slime.

SHELL resembling that of *Limax*, of an oval shape, solid and calcareous, with a transparent conchiolin base, usually somewhat convex above and concave beneath, with a few indistinct concentric lines of growth, and, according to Godwin-Austen, covered outwardly with a very thin transparent epidermis and with the boss or nucleus near the front. In young animals, the shell is very thin and convex, abruptly cut off behind, but with a projecting granular film in front.

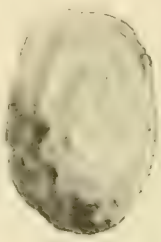


FIG. 259.—Shell of *G. maculosus* × 6. (Lough Caragh, Co. Kerry, R. F. Scharff).

FIG. 260.—Brain-ring of *G. maculosus*, from beneath, enlarged (after Scharff).

INTERNALLY, the ALIMENTARY CANAL resembles that of *Arion*; the HEART is completely surrounded by the triangular renal organ or KIDNEY, which is of lamellate structure, and discharges by means of a primary and secondary URETER; in the present group the ventricle of the heart is directed towards and in close proximity to the ANAL and RESPIRATORY ORIFICES, while in *Arion* it is more remote and in a more posterior position; the SUPRAPEDAL GLAND is deeply imbedded in the tissues and reaches far back; SEMPER'S ORGAN is well developed and chiefly shown as a pair of strong flattened lobes; the SALIVARY and DIGESTIVE GLANDS are as in *Arion*, but the vestigial osphradium within the mantle chamber is more distinct.

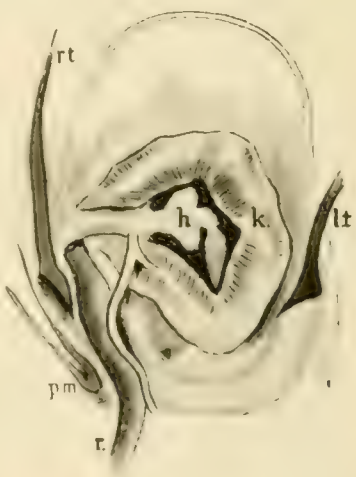


FIG. 261.—Pallial organs and cephalic retractors of *G. maculosus* × 3 (after Godwin-Austen).

h. heart; *k.* kidney; *l.t.* left tentacular retractor; *r.t.* right tentacular retractor; *r.* rectum; *p.m.* pharyngeal retractor.

The CEPHALIC RETRACTORS have the typical Arionine character; the right and left TENTACULAR muscles divide early for the upper and lower tentacles, but only those of the ommatophore are darkly pigmented, and are attached basally to the right and left posterior mantle margins respectively; the PHARYNGEAL retractor is, as usual, furcate for attachment to the rear of the BUCCAL BULB, its root being fixed on the right-side of the body, just behind the point of fixation of the right tentacular muscle.

The REPRODUCTIVE ORGANS possess a small, compact, and darkly pigmented OVOTESTIS, and the HERMAPHRODITE DUCT is very long and greatly convoluted, terminating in a small spherical VESICULA SEMINALIS; the ALBUMEN GLAND is elongated and linguiform; OVISPERMATODUCT also very much twisted; the FREE OVIDUCT rather long and thin, but without any enlargement; VAS DEFERENS very long, complexly twisted, and rolled up in the form of a bundle; SPERMATHECA globular, with short stem, but quite distant from the genital aperture, owing to

the remarkable elongation of the atrium or vestibule; the long retractor muscle from the vesicle and its stem is affixed to the dorsum in the median line near the caudal end of the body; the vas deferens and the spermatheca open nearly

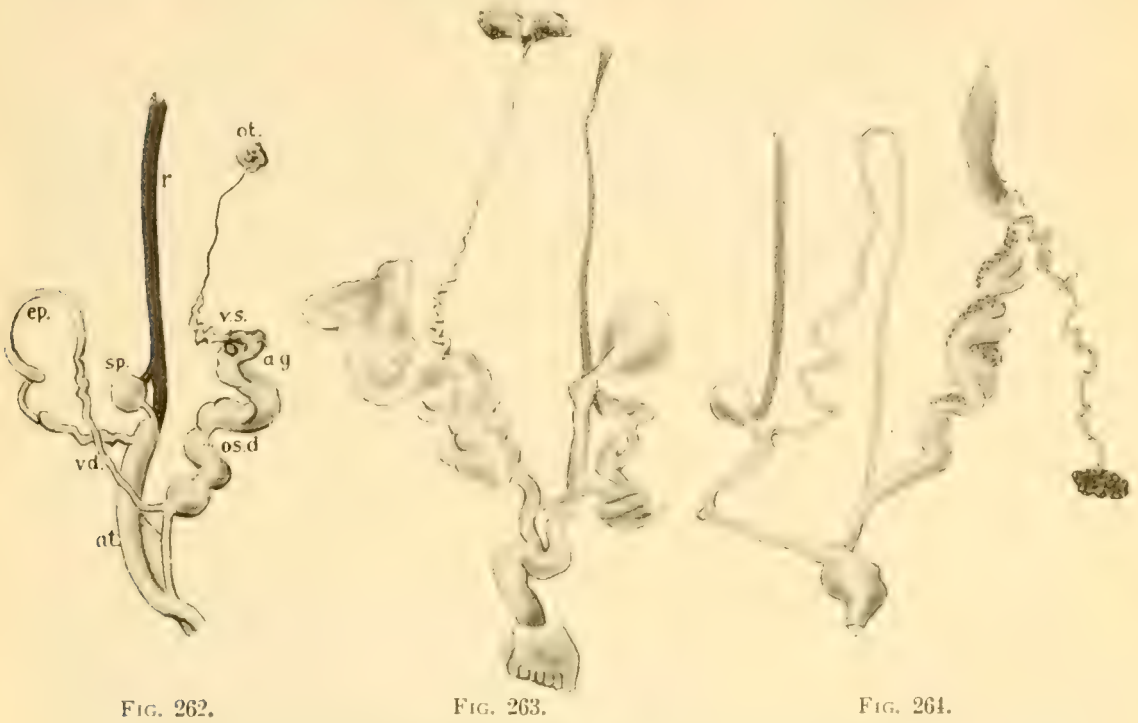


FIG. 262. FIG. 263. FIG. 264.

Sexual organs of *Geomalacus maculosus*, after dissections by Simroth (fig. 262), Godwin-Austen × 2 (fig. 263), and Scharff (fig. 264).

a.g. albumen gland; *at.* atrium; *ot.* ovotestis; *os.d.* ovispermatoduct; *ep.* epiphallus; *sp.* spermatheca; *v.d.* vas deferens; *v.s.* vesicula seminalis; *r.* retractor.

together into the distal extremity of the ATRIUM, which is prolonged in an attenuate form to an enormous length, and receives the very thin free oviduct much nearer the proximal end, where the muscular VESTIBULE is greatly but irregularly enlarged, and connected to the oviduct by a number of muscular fibres. Within the VAGINA there is a curious series of flattened folds, the central part with pointed end, placed close to the genital aperture, and which Godwin-Austen thinks may possibly be a SARCOBELUM and the homologue of the dart in the Helicidae.

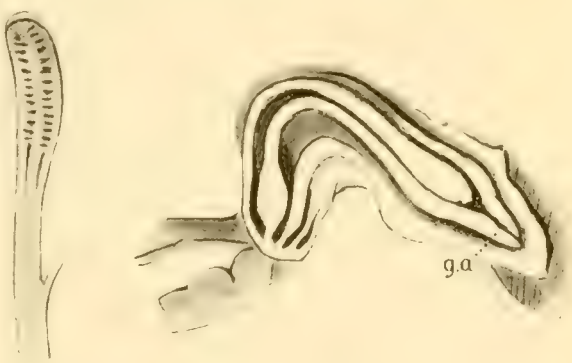


FIG. 265. FIG. 266.

FIG. 265.—Section of upper portion of Atrium × 5 after Simroth).

FIG. 266.—Internal structure of the vagina × 6 (after Godwin-Austen). *g.a.* generative orifice.

The MANDIBLE, or jaw, measures about one mill. from side to side, and is distinctly arcuate from front to rear, lunate in shape, but very wide, with broad and scarcely rounded ends, solid, dark-brown in color, with about ten broad flat ribs, which are confined to the median part of the jaw, and absent or scarcely discernible on the side areas, sometimes crenulating the upper and sometimes the lower margin or the ribs may extend quite across the jaw and denticulate both the upper and the cutting edges.

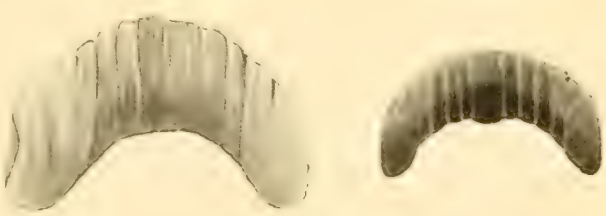


FIG. 267. FIG. 268.

Mandible or jaw of *Geomalacus maculosus* to show the variation in sculpture.

FIG. 267.—Showing the denticulation of the upper margin × 20 (after Godwin-Austen).

FIG. 268.—Showing denticulation of lower margin × 12.

The LINGUAL MEMBRANE is about eight mill. long and two mill. wide, and is said by Heynemann to be composed of 240 slightly curved transverse rows of denticles, each row composed of a median tooth and fifty-seven lateral and marginal teeth at each side. The median teeth are small and clearly unicuspid, though slightly shouldered; the lateral teeth are all bicuspid, but the admedian teeth are noticeably larger than the median row, and the mesocone is well developed, there is, however, no distinction between the lateral and marginal series except that the ectocone present on the admedian teeth recedes in position and slightly diminishes in size in the succeeding teeth up to about the twentieth row, but in the marginal series the ectocone gradually grows in size and importance as the margin is approached, while the mesocone becomes almost correspondingly diminished, the outermost teeth showing a more embryonic character; judged by the theory of meso-metamorphosis the tendency of the teeth development is towards an unicuspidate dentition.

FIG. 269.—Representative denticles from a transverse row of the teeth of *Geomalacus maculosus*, from Lough Caragh, Ireland; from a preparation by Rev. Prof. H. M. Gwatkin.

The formula of a Lough Caragh specimen is, according to Heynemann:

$$\frac{33}{2} + \frac{27}{2} + \frac{1}{1} + \frac{27}{2} + \frac{33}{2} \times 240 = 27{,}600.$$

Reproduction and Development.—The congress of this species has not been observed or described, but judging by its structure, it is, according to Simroth, probably similar to that of *Limax maximus*, the long protruding penes intertwining spirally together during the process, as in the latter species. The spermatozoids must possess a very persistent vitality or the animal be capable of autofecondation, as a specimen kept in solitary confinement for three years by Mr. T. Rogers, from August 1875, to July 19th 1878, deposited batches of fertile eggs in August 1876, and in July and August of 1877.

FIG. 270.—Cluster of eggs of *Geomalacus maculosus*, deposited in captivity (photo. by Mr. R. Welch).

The eggs have been observed to be deposited during July and August, in clusters of eighteen to twenty-four, adherent by a mucous-film; they are very large in comparison with the size of the animal, but vary within certain limits, the largest are more elongate, being eight-and-half by four-and-quarter mill., while the smallest are more regularly oval, and are only six by four mill. All the eggs when fresh are beautiful semitranslucent milky-white or opalescent, but some of the larger and more elongate ones show a somewhat transparent area at the smaller end. In a few days the opalescent lustre becomes lost, and the eggs turn yellowish and afterwards brown. The young appear to hatch in from six to eight weeks, at which period the spots are barely present, but the lateral bands are distinct and black, and the shield shows the lyre-

FIG. 271.—*G. maculosus* when immature, showing the greater distinctness of the longitudinal banding (after Scharff).

shaped markings, as in *Arion*, but these become indistinct as growth proceeds; they probably pass the winter in the immature stage, and still show at that period the lateral banding much more conspicuously than at maturity, a state which they attain during the early summer months.

Food and Habits.—The immature animals are much less sluggish and shy than the adults, and crawl actively about, the movements of the locomotory muscles being distinctly apparent in the somewhat transparent mid-area of the sole, and showing about fifteen muscular waves at one time. The animal, even when fully grown, can elongate and flatten its body to such a degree that it is able to insinuate itself and pass through a hole only two mill. in diameter, but when handled or irritated it has a curious habit of coiling-up into a perfect sphere, exactly in the same way as certain species of woodlice.

The habitats of *Geomalacus* in Ireland are by preference near the sea-coast, on the bare mountain slopes of the Old Red Sandstone formation, which are partially covered with a peaty soil overspread by heather, etc., and on which the exposed, deeply-rifted rock surfaces are chequered by lichens,

FIG. 272.—Rifted Old Red Sandstone rocks, in Cloonee Glen, near Kenmare, showing the character of the ground on which *Geomalacus maculosus* abounds (photo. by Mr. R. Welch).

liverworts, and mosses, whose luxuriant growth is favoured by the moist, warm vapours brought in by the south-west winds from the Gulf-Stream, and which also form the driving mists and clouds which are so characteristic a feature of the *Geomalacus* area, as all the loftier hills are almost constantly mist-drenched when rain is not actually falling.

It is a truly geophilous species, and very seldom ascends trees, though occasionally found thereon, but like other slugs, especially when young, is capable of spinning mucus-threads, and in captivity has been observed by Mr. H. W. Kew to quickly produce one a foot in length. At ordinary times, not only on dull, cloudy, damp days, but also occasionally during sunny weather, *Geomalacus* lives and rests quite openly and conspicuously

uncovered upon the rocks amongst the dark-grey lichens, whose white and yellowish fructifications conceal the slug perfectly, and is a striking instance of protective coloration,[1] as they so closely resemble clumps of moss or lichens. The discoverer, Mr. W. Andrews, especially remarked

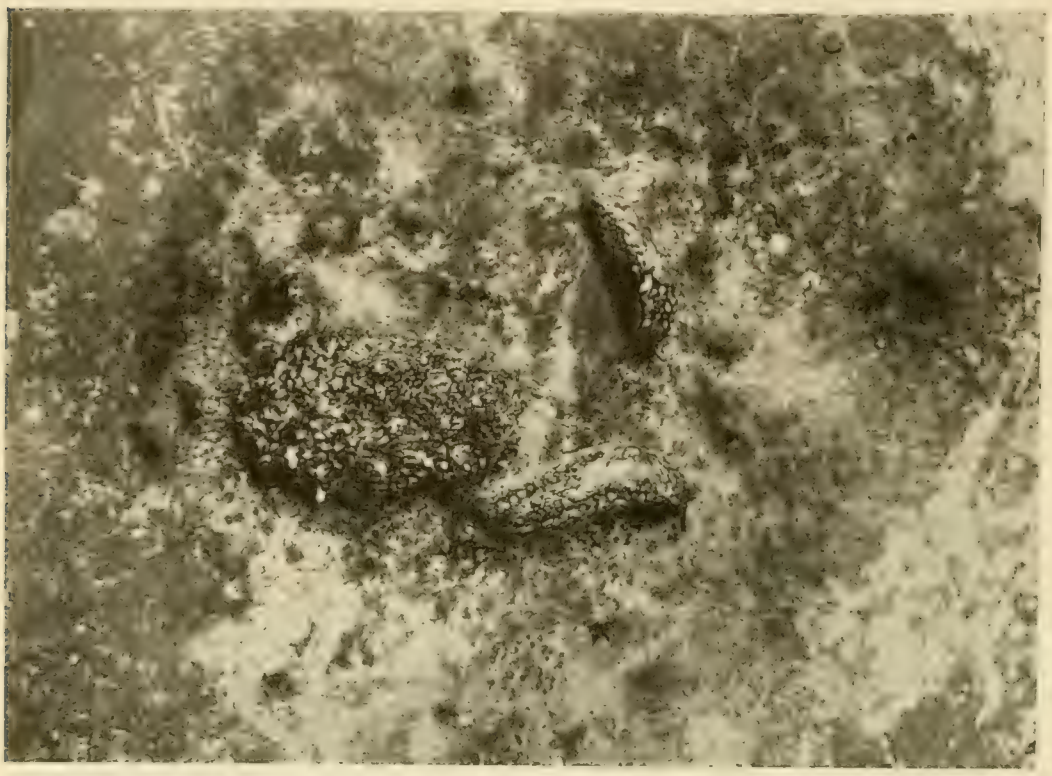


FIG. 273.—*Geomalacus maculosus* var. *fasciata* at rest on the lichen-covered rocks of Cloonee, showing their protective resemblance to their environment (photo. by Mr. R. Welch).

upon finding specimens amid the tufts of *Hylocomium splendens* and *Oscillatoria friesii*, which abound in masses at the shaded base of the moist rocks at Oulough. In times of drought, in favourable localities they swarm out of their damp retreats before sunset to feed, their tentacles being then only partially protruded, they disappear again soon after sunrise, burrowing

1 Mr. David McArdle, of the Royal Botanic Gardens, Glasnevin, Dublin, has kindly furnished me with the following list of the more prevalent Hepatics, Lichens, and Mosses, found in the area inhabited by *Geomalacus*, the publication of which it is hoped will lead to the discovery of the special food plants, and to the identification of the plant or plants to whose similarity it owes its protective resemblance.

The LICHENS are very generally distributed, but *Leptogium tremelloides* L. is partial to old wood banks, rocks, etc.; *Parmelia saxatilis* to old walls and rocks; *Cladonia rangiferina* L., *C. cervicornis* Ach., and *C. coccifera* L. to heath or peat and rock-crevices; *Usnea barbata* Fries is found on branches and trunks of trees and affords much shelter; while *Peltigera canina* L. and *Sticta pulmonacea* Ach. grow in clumps on rocks and damp banks.

The HEPATICS are apparently more local. *Scapania resupinata* L., *Diplophyllum albicans* L., *Kantia trichomanis* L., and *Cephalozia bicuspidata* L. being found on rocks and banks about Berehaven. Between the Tunnel and Glengariff, *Marsupella emarginata* Ehrh., *Nardia scalaris* Schrad., *Pellia epiphylla* L., *P. calycina* Taylor, *Conocephalus conicus* Nech., *Metzgeria furcata* L., *Frullania dilatata* L., and *F. tamarisci* L. are the prevalent species; while on old walls and banks about Kenmare and Cloonee are *Plagiochila asplenioides* L. and *P. spinulosa* Dicks, *Marchantia polymorpha* L., *Lunularia cruciata* L., and large patches of *Lejeunea serpyllifolia* Dicks, with *Trichocolea tomentella* Ehrh., *Lepidozia reptans* L., *Lophocolea bidentata* L., and *L. cuspidata* Limpr.

The MOSSES are also localized: *Homalia trichomanoides* Hedw., with *Neckera crispa* Hedw., occur in large patches on the trunks of trees, while *Brachythecium velutinum* B. & S., *Campylopus atrovirens* De Not., *Hylocomium loreum* B. & S., and *H. splendens* B. & S., are found on the mountain sides and old walls and logs between Kenmare and Cloonee. Between the Tunnel and Glengariff, *Breutelia chrysocoma* Lindb., *Campylopus flexuosus* Brid., *Dicranum scoparium* Hedw., *Hylocomium triquetrum* B. & S., *Porotrichum alopecurum* Mitt., *Climacium dendroides* W. & M., *Plagiothecium undulatum* B. & S., *P. borrerianum* Spruce, *Hypnum cupressiforme* L., and its var. *filiforme* occur; while common and generally distributed about Berehaven are *Campylopus fragilis* B. & S., *Bartramia pomiformis* Hedw., *Dicranum bonjeani* De Not., and *Weissia rupestris* C.M.; *Bryum pseudotriquetrum* Schwr. occurs in large masses about heaths and rocks, *B. alpinum* Huds., and *Ptychomitrium polyphyllum* Fürn. on rocks, and *Racomitrium lanuginosum* Brid. on rocky banks.

in the earth or flattening their bodies and penetrating deep down into the deep and narrow rock-crevices, where they hide during the day.

In captivity, they are described as very sluggish, and as lying for days without movement, but they feed freely on bread, carrot, cabbage, dandelion, cucumber, and lettuce, but are also carnivorous, and even predacious, having been noticed to devour the animals of *Vitrina pellucida* and other species contained in the same receptacle. Dr. Scharff has verified by microscopical examinations of the contents of their stomach that naturally their food is probably restricted to the various lichens and liverworts, one of the most abundant species in the locality frequented by the slug being *Frullania dilatata*, but in captivity they readily feed upon the lichen *Cladonia fimbriata*.

Variation.—The variation of this species is due to the true ground colour varying from yellow to white, and also to the degree to which it is overspread by a darker shade, which may vary from pale-grey or greenish-grey to almost uniform jet-black specimens, such as those found plentifully by Mr. A. W. Stelfox on a grassy bank by the roadside on the often cloud-capped hill near Glengariff. The paler varieties, according to the careful observations of Mr. R. Welch, are more frequent upon the somewhat dry walls bounding the roadside, while the blacker forms were more plentiful on or near the damp rock surfaces. The variation of the ground colour from white to yellow gives, as a consequence, a stronger yellow staining to the dermal-slime.

VARIATIONS IN COLOUR AND MARKINGS OF ANIMAL.

Var. **allmani** Heynemann, Mal. Bl., 1873, p. 28, pl. 1.

Geomalacus maculosus var. *allmani* Heynemann, op. cit.

ANIMAL dark brown or blackish-grey, with whitish maculations.

IRELAND.

Cork S.—Glengariff (Stubbs and Adams, Irish Nat., Nov. 1898, p. 261).

Kerry—Two or three on the trunk of a tree, in company with *Limax arborum* var. *bettonii*, north of Lough Caragh, June 1904 ! W. West. An island in Dingle Bay, W. Andrews (specimens in Coll., Brit. Mus.). Abundant on damp rocks and along the peat margins close to rocks by Lower Cloonee Lake, July 1898, R. Welch.

Var. **verkruzeni** Heynemann, Mal. Bl., 1873, p. 31.

Geomalacus maculosus var. *verkruzeni* Heynemann, op. cit.

ANIMAL grey, darker dorsally, with white maculations.

IRELAND.

Kerry—Lough Caragh (Heynemann, op. cit.).

CONTINENTAL DISTRIBUTION.

Portugal—Simroth refers to var. *verkruzeni*, a specimen from Las Caldas de Gerez, in the province of Minho, described as pale-grey, toning to olive-green, with yellowish-white fleckings.

Var. **andrewsi** Mabille, Rev. et Mag. Zool., 1867, p. 57.

Geomalacus andrewsi Mabille, op. cit.

ANIMAL whitish, overspread with blackish spots.

This variety, named by Mabille, was originally based on a misapprehension of the description of the English authors; we have, however, Dr. Jeffreys authority for the actual occurrence of whitish specimens with black spots.

IRELAND.

Kerry—Rocks along shores of Lough Caragh near Killarney (Jeffreys, Conch., v., 155, 1869).

Var. **fasciata** Cockerell, Brit. Nat. Cat. Brit. Moll., 1890, p. 18.

Geomalacus maculosus var. *fasciata* Cockerell, op. cit.

ANIMAL white or whitish; mantle marbled with black or dark-brown, and with dark lateral bands; body scarcely marbled, pale, with a dark longitudinal subdorsal and lateral band on each side.

This variety is atavistic, retaining to a large extent the characteristic markings of juvenile specimens.

IRELAND.

Kerry—An island in Dingle Bay, W. Andrews (specimens in Coll., Brit. Mus.). Near Lower Cloonee Lake, July 1898, R. Welch.

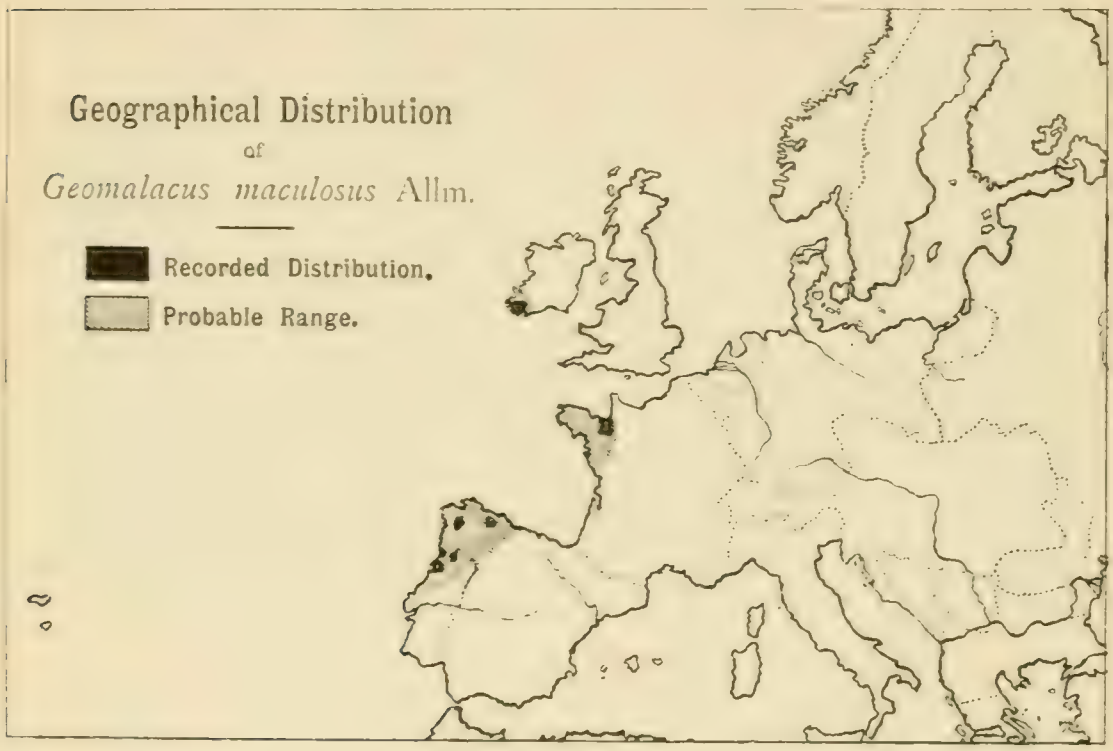


FIG. 274.

Geographical Distribution.—The range of this waning species is very limited, and its known habitats are markedly discontinuous, as the only recorded places of occurrence in the British Isles are in the extreme south-west corner of Ireland, which is also a last haven of refuge for other forms of life, verging upon extinction in this country.

It is also recorded from the north-west of France, the extreme north-west of Spain, and the north of Portugal.

It has been reported also from North-east France, but the district cited is not a very probable one for the species.

IRELAND. *MUNSTER.*

Cork S.—Found at Castletown-Berehaven, and abounds at Glengariff from the water's edge up to a considerable height, May 1891, R. F. Scharff. Very large and almost jet-black specimens abundant on a grassy-bank by roadside just below the tunnel near Glengariff, April 1899, A. W. Stelfox.

Kerry—On the Old Red Sandstone rocks at Oulough, and in the Glen of Limnavar by the margin of Lough Caragh, autumn 1842, W. Andrews (G. J. Allman, op. cit., p. 298). Many specimens of vars. *allmani* and *fasciata* in the British Museum, from an island in Dingle Bay, presented by Mr. W. Andrews. In a small valley, on a promontory, west of Derrynane Bay, from sea-level up to an altitude of more than 1,000 feet on Coad Mountain, between Caherdaniel and Sneem, July 1892, R. F. Scharff. Found by Dr. Scully at an elevation of 1,000 feet near

Distribution of *Geomalacus maculosus* Allm.

In the Counties and Vice-Counties of the British Isles.

ENGLAND AND WALES.

Channel Isles
PENINSULA
1 Cornwall W.
2 Cornwall E.
3 Devon S.
4 Devon N.
5 Somerset S.
6 Somerset N.
CHANNEL
7 Wilts N.
8 Wilts S.
9 Dorset
10 Isle of Wight
11 Hants S.
12 Hants N
13 Sussex W.
14 Sussex E.
THAMES
15 Kent E.
16 Kent W.
17 Surrey
18 Essex S.
19 Essex N.
20 Herts.
21 Middlesex
22 Berks.
23 Oxford
24 Bucks.
ANGLIA
25 Suffolk E.
26 Suffolk W.
27 Norfolk E.
28 Norfolk W.
29 Cambridge
30 Bedford
31 Hunts.
32 Northampton
SEVERN
33 Gloucester E.
34 Gloucester W.
35 Monmouth
36 Hereford
37 Worcester
38 Warwick
39 Stafford
40 Salop
SOUTH WALES
41 Glamorgan
42 Brecon
43 Radnor
44 Carmarthen
45 Pembroke
46 Cardigan
NORTH WALES
47 Montgomery
48 Merioneth
49 Carnarvon
50 Denbigh
51 Flint
52 Anglesey
TRENT
53 Lincoln S.
54 Lincoln N.
55 Leic. & Rutld.
56 Notts.
57 Derby
MERSEY
58 Cheshire
59 Lancashire S.
60 Lan'shire Mid
HUMBER
61 S.E. York
62 N.E. York
63 S.W. York
64 Mid W. York
65 N.W. York
TYNE
66 Durham
67 Northumb. S.
68 Cheviotland
LAKES
69 Westmorland and L. Lanes.
70 Cumberland
71 Isle of Man

SCOTLAND.

W. LOWLANDS
72 [illegible]
73 Kirkcudbright
74 [illegible]
75 Ayr
76 [illegible]
77 [illegible]
E. LOWLANDS
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
E. HIGHLANDS
8 Fife & Kinross
[illegible]
87 Pth. S. & Clkn.
[illegible]
[illegible]
90 [illegible]
91 Kincardine
92 Aberdeen S.
E. HIGHLANDS
93 Aberdeen N.
94 Banff
95 Elgin
96 Easterness
W. HIGHLANDS
97 Westerness
98 Main Argyle
99 Dumbarton
100 Clyde Isles
101 Cantire
102 Ebudes S.
103 Ebudes Mid
104 Ebudes N.
N. HIGHLANDS
[illegible] Ross W.
[illegible] Ross E.
[illegible] Sutherland E.
[illegible] SutherlandW
109 Caithness
NORTH ISLES
110 Hebrides
111 Orkneys
112 Shetlands

IRELAND.

ULSTER
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
LEINSTER
[illegible] Louth
[illegible] Meath
[illegible] Dublin
[illegible] Kildare
[illegible] Wicklow
[illegible] Wexford
[illegible] Carlow
[illegible] Kilkenny
[illegible] Queen's Co.
[illegible] King's Co.
[illegible] Westmeath
[illegible] Longford
CONNAUGHT
[illegible] Roscommon
[illegible] Leitrim
[illegible] Sligo
[illegible] Mayo E.
[illegible] Mayo W.
[illegible] Galway W.
[illegible] Galway E.
MUNSTER
141 Clare
142 Limerick
143 Tipperary N.
144 Tipperary S.
145 Waterford
146 Cork N.
147 Cork S.
148 Kerry

Recorded Distribution.

Distribution verified by the Authors.

the tunnel on the road between Kenmare and Glengariff (id., Proc. Mal. Soc., Oct. 1893, p. 18). On an old moss-covered wall, about sea-level, near Garinish Point, May 1893, David McArdle. Common along the shores of Inchiquin Lake, April 1899, A. W. Stelfox. Derreen, June 1899 ! W. Holbron. Abundant on damp cloudy days about Lower Cloonee Lake, and for a distance of about eight or nine miles as far as the western end of Mucksna Woods, Kenmare, resting on the dry stones of the dykes, and greatly resembling the clumps of moss and lichen thereon, but still more plentiful on damp rock surfaces and along the peat margins, close to the rocks, where they swarmed out of the hiding-places in the afternoon after five o'clock. This area, which is situate between Kenmare Bay and Berehaven, is evidently the metropolis of the species, as nowhere else are they so plentiful, though at Glengariff the specimens are finer, May 1897, R. Welch. Waterville, Aug. 1904, Prof. J. Joly. A sub-var. of a greenish colour with yellow spots has been found at Kenmare (Stubbs and Adams, Irish Nat., Nov. 1898, p. 261). Deenish Island (S. W. Kemp, Irish Nat., Dec. 1905).

FRANCE.

Recorded by Desmars from the Avenue of Conlo near Vannes, Ille et Vilaine.

SPAIN AND PORTUGAL.

Spain—Recorded by Dr. Paul Fischer as abundant in the province of Asturias, in which district, near to Santa Albas, Lucas von Heyden found a single specimen in 1868. Dr. Simroth records it as occurring in Galicia.

Portugal—Recorded only from the province of Minho; among lichens at foot of a granite wall, Las Caldas de Gerez, by Simroth; for Oporto by Mr. Newton; and on Mount Sylvestre near Vianno de Castello by Silva e Castro, who described it as new under the name of *Letourneuxia lusitana*.

FIG. 275.—Head of Inchiquin Lake, with the cloud-capped Knockreagh Mountain (1,611 feet alt.) on the right, and Cummeenanimma (1,588 feet alt.) on the left; a typical habitat of *Geomalacus maculosus* (photo. by Mr. R. Welch).

APPENDIX.

Much additional information concerning the various slugs has been acquired since the publication of the different parts dealing with the subject which is appended hereto, so that the knowledge of the different species may be brought down to date.

FAMILY TESTACELLIDÆ Gray.

GENUS *TESTACELLA* Cuvier.

Generic Characteristics.—The SUPRA-PEDAL GLAND of *Testacella* is intimately united to the pedal ganglia by a mass of connective tissue, and according to André, differs entirely from that of any other group in being totally destitute of the investment of vibratile cilia, which in other species aids in the exudation of the locomotory mucus.

Testacella haliotidea Draparnaud.

ENGLAND AND WALES.

Devon N.—Garden, Barnstaple (Rev. C. Chichester, J. of C., Oct. 1904, p. 124).
Wilts. S.—Longleat Gardens, near Warminster, Aug. 1904 ! J. A. Singer.
Surrey—Wallington (C. Pannell, junr., Journ. of Conch., July 1903, p. 331).
Suffolk W.—Sudbury, E. Ransom, Sept. 1905.
Norfolk W.—Didlington Hall, Sept. 1904 ! Hon. Mrs. Evelyn Cecil.
Hunts.—Garden, Huntingdon, Sept. 1904 ! Miss E. M. Foster.
Radnor—Pen-y-Bont, Nov. 1903 ! F. Hall.
Lancashire S.—Garden, Liverpool, Aug. 1890, W. J. Farrar.
York S.W.—Garden, Thornfield, Frizinghall, May 1900, F. Rhodes.
Cumberland—Greenhouse, Ravenstone, Bassenthwaite (W. J. Farrer, Journ. of Conch., Jan. 1906, p. 154).

Sutherland E.—Introduced into garden at Brora by Mr. W. Baillie (Journ. of Conch., Jan. 1889, p. 15).

Var. trigona Gassies and Fischer.

Hunts.—Garden, Huntingdon, Sept. 1904 ! Miss E. M. Foster.

Var. albina Moquin-Tandon.

The var. *albida* of Cockerell from Gibraltar (Sc. Goss., 1885) is described as pure white, "like white pork," and is regarded by its author as distinct from var. *albina*.

Surrey—Garden, Montserrat road, Putney, J. C. Dacie.

Var. flavescens Moquin-Tandon.

Suffolk E.—Found crawling by night on the gravel-path in the rectory garden, Martlesham near Woodbridge, by Mr. Chester B. Doughty (Rev. S. Spencer Pearce, Journ. of Conch., Jan. 1904).

Testacella scutulum G. B. Sowerby.

ENGLAND AND WALES.

Sussex E.—Hastings, E. A. Butler (Jenner, Moll. East Sussex, 1885, p. 6).
Surrey—Common in gardens (which were formerly market-gardens), Wallington, June 1892, M. Gibbs.
Middlesex—South Kensington, J. H. Sikes, May 1906.
Northampton—High Park Gardens, Stamford, are in Northamptonshire and not in South Lincoln, as stated on page 19.
Worcester—Garden, King's Norton, March 1904 ! J. Madison.
Lincoln N.—Garden, Nettleton House, Caistor, Dec. 1902 ! Miss Susan Allott.
Cheshire—Garden, New Ferry (A. Leicester, J. of Conch., Jan. 1904, p. 25).
Lancashire W.—Garden, Forton, near Lancaster, 1894, W. H. Heathcote.
York S.W.—Rastrick, June 1906 ! A. C. Lane.

SCOTLAND.

Perth S. and Clackmannan—Airthrey Gardens, Feb. 1896, G. McDougall.

IRELAND.

Armagh—Tanderagee, Sept. 1904 ! J. Rea.
Fermanagh—Castle Coole, Enniskillen, Sept. 1904 ! Hon. C. L. Corrie.
Cork N.—Convamore, Ballyhooley, Sept. 1904 ! J. N. Milne.

Var. **albina** Gassies and Fischer.

IRELAND.

Kilkenny—Gardens, Bessborough, Piltown, Sept. 1904 ! Earl of Bessborough.

Testacella maugei Férussac.

Geological History. — Mr. A. Santer Kennard informs me that *Testacella maugei* has lately been found in a holocene rainwash at Porlock Weir, South Somerset.

ENGLAND.

Cornwall W.—Tresco, Scilly Isles, Nov. 1903, J. H. Sikes. Two shells found on the small ledges of rock on St. Michael's Mount, and also at Camborne (J. P. Johnson, Geol. Mag., Jan. 1903, p. 28).

Devon N.—Rev. R. W. J. Smart's garden at Bideford.

Hereford—Gardens, The Grange, Broomy Hill, Hereford, Sept. 1904 ! Miss Boycott.

IRELAND.

Kilkenny—Jenkinstown, Aug. 1903, P. H. Grierson.

NORTH AFRICA.

Morocco—Reported by M. Vaucher as common in gardens about Tangiers.

Var. **griseo-nigrescens** Gassies and Fischer.

WALES.

Pembroke—Haverfordwest, Sept. 1904 ! Price Davies.

IRELAND.

Tipperary S.—Melview, Clonmel, Oct. 1904 ! Mrs. Malcomson.

Var. **griseo-rubescens** Gassies and Fischer.

ENGLAND.

Wilts. S.—Longleat Gardens, Warminster, Aug. 1904 ! J. A. Singer.

GENUS *GLANDINA* Schumacher.

Glandina costellata (Sowerby).

Affinities.—*Glandina costellata*, according to Sandberger, closely resembles the *Glandina liebmanni* Pfr., now living in Mexico, while Noulet has proposed to unite *Glandina costellata* with the *G. naudoti*; Sandberger has, however, shown that *G. costellata* can be readily distinguished from that species by its smaller size, more slender form, and finer striation.

Geological History. — Sandberger records this species from the Palæothærium limestone of the Oligocene formation at Mas Saintes Puelles, Villeneuve, in the department of the Aude, France.

FAMILY LIMACIDÆ Gray.

GENUS *LIMAX* Linné.

Geological History.—Mr. A. S. Kennard is of opinion that the formation at Stutton, from whence the fossil shells of *Limax* were procured, and which was described by Prof. Morris as Mammalian Crag, is not crag, but a black-earth of the same age as the Crayford Beds of the Upper Pleistocene series.

Limax maximus Linné.

Description—The SUPRA-PEDAL GLAND in *Limax maximus* is arranged as in *Arion*, in the form of a ribbon, on the upper surface of the foot, and extends to half its length; the excretory canal is very capacious, and the longitudinal folds distinct, while the internal vibratile cilia which assist the outward flow of the mucus are disposed in tufts. Inside the canal a great number of a parasitic Nematode of the genus *Leptodera* may sometimes be found.

ENGLAND AND WALES.

Cornwall W.—Garden, Truro, J. H. James (T. D. A. Cockerell, Sci. Goss., May 1886, p. 114). Camborne (J. P. Johnson, Geol. Mag., Jan. 1903, p. 27).

Hants. S.—Frequent about Cosham, under faggots, etc., C. S. Coles.

Sussex E.—Under white *Arabis*, Eastbourne, July 1904 ! Montagu F. Jones.

Surrey—Tatsfield (Chas. Pannell, jun., Journ. of Conch., July 1903, p. 331). Haslemere and Grayswood (id., Apl. 1902, p. 169).

Herts.—Barnet, June 1902, H. F. Rogers. Var. *fasciata*, Codicote near Welwyn, Sept. 1904 ! Mrs. Blundell.

Berks.—Near Wellington College, Sept. 1904 ! Rev. H. P. Fitzgerald.

Suffolk E.—Lowestoft, Oulton, Brockford, and Ipswich (A. Mayfield, Journ. of Conch., April 1903, p. 294).

Suffolk W.—Fornham St. Martin near Bury St. Edmunds, Oct. 1903 ! W. R. Burrell. Sudbury, Sept. 1905, E. Ransom.

Norfolk E.—Strumpshaw Hall gardens, July 1904 ! W. J. O. Holmes.

Norfolk W.—Var. *fasciata*, King's Lynn, Sept. 1904 ! C. B. Plowright.

Bedford—Var. *fasciata*, Limbury near Luton, Sept. 1904 ! Mrs. Blundell.

Hunts.—Garden, Huntingdon, Sept. 1904 ! Miss E. M. Foster.

Hereford—Acacia Villa, Ross, Sept. 1904 ! W. C. Blake.

Worcester—Garden, Stourport, July 1888 (J. W. Williams, J. of C., July 1889).

Stafford—Worth Wood near Froghall, May 1898 (J. of Conch., Oct. 1898, p. 110).

Pembroke—Vars. *concolor* and *fasciata*, Haverfordwest, Sept. 1904 ! P. Davies.

Merioneth—Llwyngwril near Barmouth, June 1887 ! W. Cash.

Denbigh—Glyndyfrdwy, Vale of Llangollen, Aug. 1904 ! B. Tomlin.

Lincoln S.—Var. *fasciata*, old stone quarry, Great Ponton, Sept. 1904 ! H. Preston. Rippingale, Sept. 1904 ! J. Stow.

Lincoln N.—Cadney Vicarage, Dec. 1902 ! Rev. E. A. Woodruffe-Peacock.

Lancashire S.—One specimen in a wood, Bardsley, spring 1906; another at Riversvale, in June 1897 (F. Taylor, Journ. of Conch., April 1898, p. 50).

York S.W.—Frequent near houses, and also near woods at Elland Park Wood and Red Lane Dyke near Halifax (J. E. Crowther, Halifax Nat., Aug. 1903, p. 48).

York Mid W.—Horsforth, Jan. 1885 !

Cumberland—Keswick, July 1903, Rev. R. Godfrey. Gardens, Brigham, Cockermouth, July 1904 ! Mrs. Robinson. Salkeld Dykes, Aug. 1904 ! H. Britten.

SCOTLAND.

Ayr—Portincross, March 1904, Rev. R. Godfrey.

Roxburgh—Var. *sylvatica*, Langlee near Galashiels, Sept. 1904 ! J. Roseburgh.

Haddington—Tynefield, and Bill near Dunbar, Sept. 1894, also Gifford, Sept. 1896, W. Evans.

Linlithgow—Dalmeny Park, March 1891 ! near Linlithgow, Aug. 1899; also var. *cellaria*, Kinneil, Aug. 1891, W. Evans.

Fife and Kinross—Largs, Sept. 1882; Falkland, Aug. 1895; and Culross, April 1900, W. Evans.

Perth S. and Clackmannan—Dollar, April 1897, W. Evans.

Orkneys—Stromness, Aug. 1905 ! J. S. B. Headley.

IRELAND.

Derry—Var. *concolor*, Ballynagard, June 1892, D. C. Campbell.

Antrim—Sub-var. *geminipunctata*, Cushendall, Aug. 1894 ! W. Moss.

Down—Garden, Oakleigh near Belfast, Oct. 1904 ! R. Welch.

Armagh—Tynan, July 1905 ; var. *ferussaci*, Meigh, Dec. 1904, P. H. Grierson.

Monaghan—Shantonagh ; var. *ferussaci*, near Carrickmacross, P. H. Grierson.

Donegal—Var. *ferussaci*, Downhill near Londonderry, one, very characteristic, half-grown, Sept. 1904 ! C. N. Lynes.

Cavan—Kingscourt, June 1904 ; v. *fasciata*, Mullagh, Sep. 1904, P. H. Grierson.

Louth—Dundalk ; Ardee ; Millifont Abbey ; Beaulieu, Oct. 1904 ; Dromiskin, small, June 1904 ! var. *ferussaci*, Blackhall Demesne, Sept. 1904 ; var. *sylvatica*, Narrow Water, Dec. 1904 ! P. H. Grierson.

Meath—New Grange, June 1892, R. F. Scharff. Nobber ; Bective Abbey and Ballivor, March 1905 ; Athboy, Julianstown, and Kells, April 1905 ; Batterstown, May 1905 ; var. *ferussaci*, Moynalty, March 1905, P. H. Grierson.

Dublin—Killakee and Leeson Park, Oct. 1890, R. F. Scharff.

Kildare—Type and var. *sylvatica*, Lyons, Aug. 1904, P. H. Grierson.

Wicklow—Type and var. *obscura*, Greystones, Sept. 1903 ; var. *fasciata*, Enniskerry, Aug. 1904, P. H. Grierson.

Wexford—Wexford, April 1891, R. F. Scharff.

Kilkenny—Near Waterford, Jan. 1903 ; Thomastown and Jenkinstown, Feb. 1903, P. H. Grierson.

Westmeath—Large specimens, Knockdrin Demesne, April 1892, R. F. Scharff. Raharney, March, 1905, P. H. Grierson.

Roscommon—Mote Park, Roscommon, Sept. 1904 ! Lord Crofton.

Leitrim—Feenagh, 1899, P. H. Grierson.

Waterford—North of Youghal, Aug. 1902, P. H. Grierson.

Cork N.—Youghal, 1902, and Macroom, P. H. Grierson.

Cork S.—South of Macroom, May 1902 ; and Kilcrea Abbey, P. H. Grierson.

Kerry—Lough Caragh, Sept. 1890, Rev. A. H. Delap. Sub-var. *geminipunctata*, Muckross Demesne, May 1891, R. F. Scharff.

GERMANY.

Recorded for Kiel in Holstein by Friedel (Mal. Bl., 1870, p. 49).

FRANCE.

Recorded for the department of the Meuse by M. Henri Cardot, and from the Lot et Garonne by Gassies (Moll. Agenais, 1849, p. 60).

ITALY.

Recorded for La Cava near Salerno in Campania by Prof. E. von Martens (Mal. Bl., 1858, p. 149).

PORTUGAL.

According to Dr. Simroth, only the var. *cinerea* Lister is found in Portugal.

NORTH AFRICA.

Algeria—Dr. Simroth is of opinion that *Limax nyctelius* Bourg., from Algiers, is only the var. *cinerea* Lister.

ATLANTIC ISLES.

Azores—The vars. *cinerea* Lister and *unicolor* Heynemann are recorded from this group by Dr. Simroth.

Canaries—Found by Lieut.-Col. Parry at Orotava in Teneriffe, and Galdar in Grand Canary.

Madeira—Madeiran specimens, in the opinion of Dr. Simroth, are pale and strongly flecked forms of var. *cinerea* Lister.

NEARCTIC REGION.

Limax maximus is said by Mr. W. D. Hartmann to be distributed over the Eastern United States, from New York State to the Potomac River.

Pennsylvania—Westchester, Chester Co., Sept. 1885, W. D. Hartmann.

Massachusetts—Type, with vars. *obscura* and *cellaria*, collected by J. Ritchie, junr., in the suburbs of Boston, July 1905, T. D. A. Cockerell.

ETHIOPIAN REGION.

Cape Colony—" A form which may be subspecifically distinct, and reminds one of the Italian forms, found by Mr. R. M. Lightfoot, under rocks, some distance up Table Mountain " (W. E. Collinge, Ann. S. African Mus., Dec. 1901, p. 229).

AUSTRALASIAN REGION.

New Zealand—Type, with vars. *fasciata*, *cellaria*, and sub-var. *geminipunctata* in Mr. Murdoch's garden, Wanganui, North Island, Feb. 1905 ! W. D. Roebuck.

Var. **concolor** Pini.

The *Limax unicolor* Heynemann, characterized as uniformly ash-coloured, is according to Dr. Simroth, merely a form of *L. maximus*, and should therefore be placed here.

ENGLAND AND WALES.

Berks.—Near Wellington College, Sept. 1904 ! Rev. H. P. Fitzgerald.
Pembroke—Haverfordwest, Sept. 1904 ! Price Davies.
Cumberland—Salkeld Dykes, Aug. 1904 ! H. Britten.

IRELAND.

Derry—Ballynagard, June 1892, D. C. Campbell.
Kerry—Lough Caragh, Sept. 1900, Rev. A. H. Delap.

AUSTRO-HUNGARY.

The sub-var. *unicolor* Heynemann and *Limax cinereus* Lister are recorded for Buda Pesth by Hazay (Mal. Bl., 1881, p. 30).

ATLANTIC ISLES.

Azores—The sub-var. *unicolor* Heynemann is recorded by Dr. Simroth.

Var. **fasciata** Raz.

Prof. T. D. A. Cockerell distinguishes the var. *fasciata* of Moquin-Tandon from that of Razoumowsky, and has applied the name of var. *moquini* to the first-named form.

ENGLAND AND WALES.

Cornwall W.—Near Stenalee, Sept. 1904 ! C. P. Richards.
Wilts. N.—Clyffe Pybard, Swindon, Aug. 1904 ! Rev. C. H. Goddard.
Wilts. S.—Longleat gardens, Warminster, Sept. 1904 ! J. A. Singer.
Surrey—Haslemere (C. Pannell, junr., Journ. of Conch., Apl. 1902, p. 169).
Bedford—Limbury near Luton, Sept. 1904 ! Mrs. Blundell.
Herts.—Codicote near Welwyn, Sept. 1904 ! Mrs. Blundell.
Berks.—Near Wellington College, Sep. 1904 ! Rev. H. P. Fitzgerald. Bradfield, Sept. 1904 ! Rev. E. Peake.
Hunts.—Gardens, Huntingdon, Sept. 1904 ! Miss E. M. Foster.
Norfolk W.—King's Lynn, Sept. 1904 ! C. B. Plowright.
Hereford—Var. *fasciata* and sub-var. *mulleri*, Acacia Villa, Ross, Sept. 1904 ! W. C. Blake.
Brecon—Gwenddwr, alt. 1,000 ft., Aug. 1904 ! J. Williams Vaughan.
Radnor—Pen-y-Bont, Nov. 1903 ! F. Hall.
Pembroke—Haverfordwest, Sept. 1904 ! Price Davies.
Anglesey—Garden, Cemmaes. July 1895 ! (C. Oldham, J. of C., July 1898, p. 86).
Lincoln S.—Old stone quarry, Great Ponton, Sept. 1904 ! H. Preston. Rippingale, Sept. 1904 ! J. Stow.
Notts.—Sub-var. *mulleri*, Mapperley, June 1885 ! C. T. Musson.
Cumberland—Salkeld Dykes, Aug. 1904 ! H. Britten.

SCOTLAND.

Perth Mid—Inver Dunkeld, Sept. 1904 ! C. McIntosh.

IRELAND.

Derry—Gortness, Sept. 1904 ! D. C. Campbell.
Antrim—Garden, Antrim, Sept. 1904 ! W. S. Smith. Ballycastle, Oct. 1904 ! Miss F. S. O'Connor.
Armagh—Acton Glebe, Poyntz Pass, Sept. 1904 ! Rev. W. F. Johnson.
Donegal—Sub-var. *mulleri*, Templemore Park, Sept. 1904 ! D. C. Campbell.
Fermanagh—Castle Coole, Enniskillen, Sept. 1904 ! Hon. C. L. Corry.
Cavan—Mullagh, Sept. 1904, P. H. Grierson.
Dublin—Rathmines, Sept. 1904 !
Wicklow—Enniskerry and Wicklow, Aug. 1904, P. H. Grierson. Fassaroe near Bray, Sept. 1904 ! R. M. Barrington.
Carlow—Fenagh House, Bagenalstown, Sept. 1904 ! Denis R. Pack-Beresford.
Kilkenny—Kilkenny Castle gardens, Oct. 1904 ! John Carlton. Several immature, Piltown, Sept. 1904 ! Earl of Bessborough.
Queen's Co.—Stradbally, Sept. 1904 ! A. G. Stuart.

King's Co.—Abundant, the gardens, Charleville Forest, Tullamore, Sept. 1904 ! Robert McKenna.

Mayo W.—The Demesne, Westport, Sept. 1904 ! John O'Callaghan.

Galway E.—Clonbrock, Sept. 1904 ! Hon. R. E. Dillon. Kilconnell near Ballinasloe, Sept. 1904 !

Clare—Scariff, Sept. 1904 ! N. F. Hibbert. Doonass, Aug. 1904 ! R. A. Phillips.

Limerick—Mungret, Sept. 1904 ! G. J. Fogerty.

Tipperary N.—Road by Lough Derg to Ballina, Sept. 1904 ! G. J. Fogerty.

Kerry—Valentia Island, Sep. 1904 ! Miss Delap. Killflynn, Sep. 1904 ! J. Julian.

ATLANTIC ISLES.

Madeira—Var. *moquini* Cockerell (=var. *fasciata*) (J. of Mal., May 1897, p. 4).

NEW ZEALAND.

Type and vars. *fasciata*, *cellaria*, and sub-var. *geminipunctata* abundant in Mr. Murdoch's garden at Wanganui, North Island, Feb. 1905 ! W. Denison Roebuck.

Var. **sylvatica** Morelet.

ENGLAND AND WALES.

Cornwall W.—Sub-var. *quadrifasciata*, garden, Truro, J. H. James (T. D. A. Cockerell, Science Gossip, May 1886, p. 114).

Wilts. N.—Clyffe Pybard, Swindon, Aug. 1904 ! Rev. C. H. Goddard.

Norfolk E.—Var. *sylvatica* and sub-var. *serpentina*, Strumpshaw Hall, July 1904 ! W. J. O. Holmes.

Hereford—Acacia Villa, Ross, Sept. 1904 ! W. C. Blake.

Radnor—Pen-y-Bont, Nov. 1903 ! F. Hall.

SCOTLAND.

Roxburgh—Langlee near Galashiels, Sept. 1904 ! J. Roseburgh.

IRELAND.

Armagh—Tandragee, Sept. 1904 ! James Rea.

Louth—A sub-var. with finely spotted shield, Narrow Water, Dec. 1904 ! P. H. Grierson.

Kildare—Lyons, Aug. 1904, P. H. Grierson.

Kilkenny—Kilkenny, Sept. 1904 ! J. White.

Roscommon—Mote Park, Roscommon, Sept. 1904 ! Lord Crofton.

Cork N.—North bank of river Lee, Cork, Sept. 1904 ! C. Baker.

Var **krynickii** Kaleniczenko.

Dr. Martin Lister's *Limax cinereus* is, judging from the figure and description, a form of the var. *krynickii*.

ENGLAND.

Cornwall W.—Sub-var. *johnstoni*, garden, Truro, J. H. James.

Devon S.—Sub-var. *johnstoni*, Culverhole, Aug. 1892 ! L. E. Adams.

Surrey—Haslemere (C. Pannell, junr., Journ. of Conch., Apl. 1902, p. 169).

Worcester—Sub-var. *johnstoni*, garden, Stourport, July 1888 (Williams, Journ. of Conch., July 1889, p. 112).

ATLANTIC ISLES.

Azores—The sub-var. *cinerea* Lister is found on this group according to Simroth.

Madeira—The *Limax maximus* on this island are recorded by Simroth as pale and strongly flecked *L. cinereus* Lister.

PORTUGAL.

The form of *L. maximus* in Portugal is said by Simroth to be the var. *cinerea* of Lister.

NORTH AFRICA.

Algeria—The *L. nyctelius*, recorded by Bourguignat from Algiers, is said by Simroth to be the var. *cinerea* of Lister.

Var. **cellaria** d'Argenville.

ENGLAND.

Cornwall W.—Near Stenalee, Sept. 1904 ! C. P. Richards.

Norfolk E.—Strumpshaw Hall, July 1904 ! W. J. O. Holmes.

Cumberland—Sub-var. *maculata*, Bassenthwaite (W. J. Farrer, J. of Conch., Jan. 1896, p. 154).

SCOTLAND.

Linlithgow—Kinneil, Aug. 1891 ! W. Evans.

IRELAND.

Fermanagh—Enniskillen, Sept. 1904 ! Dean of Clogher.
Queen's Co.—Sub-var. *maculata*, Maryborough, Oct. 1904 !
Cork N.—Convamore near Ballyhooley, Sept. 1904 ! J. McMillar.
Cork S.—Skibbereen, Sept. 1904 ! John J. Wolfe.

NEARCTIC REGION.

United States—Type, vars. *cellaria* and *obscura*, found by J. Ritchie, junr., in suburbs of Boston, Massachusetts, July 1905 (T. D. A. Cockerell).

AUSTRALASIAN REGION.

New Zealand—In Mr. Murdoch's garden, Wanganui, North Island, with type and vars. *fasciata* and *geminipunctata*, Feb. 1905 ! W. Denison Roebuck.

Var. **ferussaci** Moquin-Tandon.

The var. *marmorata* Cockerell is, according to its author, closely allied to the sub-var. *punctata* of Esmark.

ENGLAND AND WALES.

Surrey—Var. *ferussaci* and sub-var. *marmorata*, Haslemere (C. Pannell, junr., Journ. of Conch., Apl. 1902, p. 169).
Radnor—Var. *ferussaci* and sub-var. *punctata*, Pen-y-Bont, Nov. 1903 ! F. Hall.
Anglesey—Garden, Cemmaes, and Llanbadrig churchyard, July 1895 (Chas. Oldham, Journ. of Conch., July 1898, p. 86).

IRELAND.

Antrim—Ballycastle, Sept. 1904 ! Miss F. S. O'Connor. Colin Glen, June 1884 ! S. A. Stewart. Sub-var. *geminipunctata*, Cushendall, Aug. 1894 ! W. Moss.
Armagh—Meigh, Dec. 1904, P. H. Grierson.
Monaghan—Near Carrickmacross, P. H. Grierson.
Donegal—Downhill near Londonderry, very characteristic, half-grown, Sept. 1904 ! C. N. Lynes.
Louth—Blackhall, Sept. 1904 ! and Drogheda, Oct. 1904 ! P. H. Grierson.
Meath—Moynalty, March 1905, P. H. Grierson.
Queen's Co.—Stradbally, Sept. 1904 ! A. G. Stuart.
Longford—Newtown Forbes, Sept. 1904 !
Roscommon—Mote Park, Roscommon, Sept. 1904 ! Lord Crofton.
Kerry—Sub-var. *geminipunctata*, Muckross Demesne, May 1891, R. F. Scharff.

FRANCE.

Cannes, in the Alpes Maritimes, June 1890 ! R. D. Darbishire.

RUSSIA.

Tchernigov and Poltava, erroneously recorded on p. 45 for *L. maximus* var. *ferussaci*, should refer to *L. cinereo-niger* var. *vera*, which appears to be more truly synonymous with Kaleniczenko's *Limax ferussacki*.

AUSTRALASIAN REGION.

New Zealand—The sub-var. *geminipunctata* in Mr. Murdoch's garden, Wanganui, North Island, in company with typical specimens and vars. *cellaria* and *fasciata*, Feb. 1905 ! W. Denison Roebuck.

Var. **obscura** Moquin-Tandon.

ENGLAND.

Berks.—Near Wellington College, Sept. 1904 ! Rev. H. P. Fitzgerald.
Hunts.—Garden, Huntingdon, Sept. 1904 ! Miss E. M. Foster.

IRELAND.

Armagh—Tanderagee, Sept. 1904 ! James Rea.
Kildare—Naas, Oct. 1904 ! R. J. Pack-Beresford.
Wicklow—Greystones, Sept. 1903, P. H. Grierson.
Kilkenny—Kilkenny Castle gardens, Sept. 1904 ! John Carlton.
King's Co.—Gardens, Charleville Forest, Tullamore, Sept. 1904 ! R. McKenna.
Roscommon—Old Fort, Keadue, Sept. 1904 ! James J. Welch.
Galway W.—Kylemore Castle gardens, Sept. 1904 ! W. Comfort.
Waterford—Belle Vue House, Waterford, nearly black, Sep. 1904 ! Miss Power.

NEARCTIC REGION.

United States—Type, vars. *obscura* and *cellaria*, found in suburbs of Boston, Massachusetts, by J. Ritchie, junr., July 1905 (T. D. A. Cockerell).

Limax cinereo-niger Wolf.

An example, labelled *Eumilax brandti* from the Caucasian region preserved in alcohol in the Indian Museum, seen by Mr. W. Denison Roebuck, F.L.S., appears to be *Limax cinereo-niger*.

ENGLAND.

Somerset S.—Horner (F. J. Partridge, Journ. of Mal., Sept. 1900, p. 181).
Bucks.—Burnham Beeches, Oct. 1905, H. Wallis Kew.
Cumberland—Woods at Bassenthwaite (W. J. Farrer, J. of C., Jan. 1896, p. 154).

SCOTLAND.

Perth Mid—Glen Ogle, Lochearnhead, July 1903, Rev. R. Godfrey.
Easterness—Loch-an-Eilan ! W. Evans.

IRELAND.

Mayo W.—Enniscoe near Crossmolina ! W. F. de Vismes Kane.

SWITZERLAND.

Glarus—Recorded for Richisau in Klonthal by Blum (Nachr., Aug. 1892, p. 128).

Var. **vera** Dum. & Mort.

ENGLAND.

Wilts. S.—Teffent, Sept. 1905 ! Hugh Wyndham.

IRELAND.

Antrim—Fair Head promontory nr. Ballycastle, Oct. 1904 ! Miss F. S. O'Connor.

Var. **cinereo-nigra** Wolf s.s.

ENGLAND AND WALES.

Essex S.—Sub-var. *luctuosa*, under bark, at Loughton in Epping Forest, Oct. 1904, T. Petch.
Stafford—Sub-var. *luctuosa*, Stafford, Lionel E. Adams.
Radnor—Sub-var. *luctuosa*, Aberedw ! Aug. 1904, J Williams Vaughan.
Lincoln S.—Sub-var. *luctuosa*, Careby Wood, June 1903 ! Rev. E. A. Woodruffe-Peacock.
Derby—Sub-var. *luctuosa*, Chapel-en-le-Frith, July 1897, C. Oldham.
Cheshire—Sub-var. *luctuosa*, Taxal, May 1898, C. Oldham.

SCOTLAND.

Perth S. and Clackmannan—Sub-var. *razoumowskii*, Balquidder, July 1904 ! Rev. R. Godfrey.
Easterness—Sub-var. *luctuosa*, in pine forest at Rothiemurchus, Aug. 1904 ! Rev. R. Godfrey.

IRELAND.

Donegal—Sub-var. *hedleyi*, Ray Wood, Rathmullan, recorded by W. E. Collinge, is in County Donegal.

Var. **maura** Held.

The *Limax maximus* var. *carbonaria* Böttger (Jahrb. Deutsch. Mal. Gesellsch., 1885, p. 159, pl. 4, f. 6) is, judging from the description and figure, probably equivalent to the var. *maura* of *L. cinereo-niger*.

ENGLAND.

Stafford—Stafford, Lionel E. Adams.

SCOTLAND.

Easterness—Rothiemurchus pine forest, Aug. 1904 ! Rev. R. Godfrey.

GREECE.

Thessaly—*Limax maximus* v. *carbonaria* Böttger, Ossagebirges (Böttger, l.c.).

Var. **efasciata** Dum. & Mort.

SCOTLAND.

Easterness—Rothiemurchus pine forest, Aug. 1904 ! Rev. R. Godfrey.

Limax tenellus Müller (em. Nilsson).

The hope expressed that this species would probably be rediscovered in the British Isles when the attention of malacologists was directed to its habits and peculiarities, has been happily justified, as in August 1904, Mr. W. Denison Roebuck verified this long-lost species in a consignment of slugs sent by the Rev. R. Godfrey who, inspired by his experience in finding the species in Switzerland in a previous season, had searched for it in the forest of Rothiemurchus, and found it to be the commonest slug there, associated with *Arion minimus*, *A. subfuscus*, *Limax arborum*, and *L. cinereo-niger*, amongst decaying pine-needles. Attention being thus called to the habitat search was made in other districts, and the species has since been actually found in seven widely-separated counties.

Food and Habits.—The activity and restlessness of this species has been verified in this country, as also its partiality for shade and concealment, while according to the observations of Mr. Petch it also possesses, though in a more striking degree, the habit of *Limax maximus* of everting the fore-part of the mantle when irritated.

The locomotory slime is colourless, while that of the body is yellow. The species is evidently widely distributed and common in Epping Forest, amongst Pollard Hornbeams and Beeches, frequenting in company with *Arion intermedius* the varied species of fungi, *Lactarius blennius*, *L. vellereus*, *Collybia maculata*, *Russula fellea*, *R. vesca*, and *R. cyanoxantha* being noted as especially attractive.

In Clackmannan, Mr. W. Evans found this species frequenting the fungus *Russula emetica*, but most frequently, however, hiding beneath fallen bark and chips of wood beneath the fir trees in company with *Arion subfuscus* and *A. intermedius*. In captivity the animals feed on various kinds of *Boletus*, *Russula*, and other woodland Agarics.

AUSTRALASIAN REGION.

Sandwich Islands—Recorded by Herr Semper (W. E. Collinge, Journ. of Mal., April 1896, p. 50).

Var. cerea Held.

ENGLAND.

Bucks.—Burnham Beeches, Oct. 1905 ! H. Wallis Kew.

Essex S.—Common and widely distributed, Loughton, Epping Forest, Oct. 1904 ! Tom Petch.

York N.W.—Hall Wood, Healey near Masham, Oct. 1904 ! W. A. Thwaites.

SCOTLAND.

Perth S. and Clackmannan—Clackmannan pine forest, Sept. 1904 ! W. Evans.

Perth Mid—Inver Dunkeld, Sept. 1904 ! A. Rodgers.

Kincardine—Invercannie, Banchory, Sept. 1904 ! G. Sim.

Easterness—Abundant in Rothiemurchus forest, Aviemore, Aug. 1904 ! Rev. R. Godfrey.

SWITZERLAND.

In fir wood near Lucerne, July 1902 ! Rev. R. Godfrey. In pine wood between Casaccia and Vicosoprano in the Grisons (Rev. S. Spencer Pearce, Journ. of Conch., July 1887, p. 213).

Var. fulva Normand.

Easterness—One, Rothiemurchus forest, Aug. 1904 ! Rev. R. Godfrey.

Var. cincta Heynemann.

Essex S.—Loughton in Epping Forest, Oct. 1904 ! T. Petch.

GERMANY.

Thuringia—Saalfeld (Von Martens, Jahrb. Deutsch. Mal. Ges., 1877, p. 226).

Sub-Genus *Lehmannia* Heynemann.

Limax flavus Linné.

ENGLAND AND WALES.

Hants. N.—Swarraton near Alresford, May 1906 ! Rev. W. L. W. Eyre.
Sussex E.—Queen's Park road, Brighton, Oct. 1903 ! F. G. S. Branwell.
Kent E.—Maidstone (Elgar and Lamb, Journ. of Conch., Jan. 1893, p. 154).
Surrey—Limpsfield (C. Pannell, Journ. of Conch., April 1902, p. 169); South Norwood; Tennyson's lane, Haslemere; and Pitfold Hollow, Shottermill (id., July 1903, p. 331).
Suffolk W.—Sudbury, Sept. 1905, E. Ransom.
Norfolk E.—Strumpshaw Hall, July 1904 ! W. J. O. Holmes. Outhouses, etc., Yelverton and Framingham Earl (Pearce and Mayfield, J. of C., July 1894, p. 393).
Hunts. Type and var. *rufescens*, garden, Huntingdon, Sept. 1904 ! Miss E. M. Foster.
Gloucester E.—Garden, Argyll House, Cirencester, Aug. 1904 ! Mrs. Blundell.
Pembroke—Haverfordwest, Sept. 1904 ! Price Davies. Common under stones and refuse on the North Cliff near the harbour, Tenby (A. G. Stubbs, J. of Conch., July 1900, p. 322).
Cheshire—Var. *tigrina*, in cellar, Liverpool road, Chester, Oct. 1903 ! B. Tomlin.
Lancashire S.—Coldhurst street and Vineyard street, Oldham (F. Taylor, J. of Conch., Apl. 1898, p. 50).
York S.W.—A large colony in an empty house at Elland (J. E. Crowther, Halifax Naturalist, Aug. 1903, p. 48).
York Mid W.—Swarming in cellars and garden of Buck Inn, Buckden, Aug. 1904 ! W. Denison Roebuck.
Cumberland—On ruins of old mill, Bassenthwaite, and on a wall, Keswick, W. J. Farrer (Journ. of Conch., Jan. 1896, p. 154).

SCOTLAND.

Clyde Isles—Brodick, Isle of Arran, Apl. 1906, J. H. Sikes.

IRELAND.

Down—A colony of very large specimens at the Old Castle, Ardglass, and at Hillsborough; also Mr. Stelfox's garden, Oakleigh, Belfast, Oct. 1904 ! R. Welch.
Armagh—Armagh, Dec. 1904; and Tynan, July 1905, P. H. Grierson.
Monaghan—Near Carrickmacross, July 1904 ! P. H. Grierson.
Cavan—Kingscourt, June 1904, P. H. Grierson.
Louth—Ardee, Apl. 1904; Louth, Nov. 1904; Togher, Apl. 1905; Drogheda, May 1905; and Carlingford, July 1905, P. H. Grierson.
Meath—Drumcondra, July 1904; Slane, Jan. 1905; Kells and Julianstown, Apl. 1905; sub-var. *suffusa*, Duleek, Nov. 1904 ! P. H. Grierson.
Kildare—Lyons, Aug. 1904 ! P. H. Grierson.
Wicklow—Var. *flavescens*, Enniskerry, Aug. 1904, P. H. Grierson.
Carlow—Pollacton gardens, Carlow, Sept. 1904 !
Westmeath—Raharney, March 1905, P. H. Grierson.
Tipperary N.—Abundant in tree hollows in Monastery, Cashel, R. Welch.
Waterford—Cappoquin, Nov. 1902, P. H. Grierson.
Cork N.—Near Macroom, June 1903, P. H. Grierson.

FRANCE.

Lot et Garonne (Gassies, Moll. Agenais, 1849, p. 62), recorded by M. Henri Cardot for the Ardennes and the Meuse, and by Captain Wattebled for the Jura.

AUSTRO-HUNGARY.

Dalmatia—Herr Clessin cites this species as plentiful at Krkafällen.

NORTH AFRICA AND ASIA MINOR.

Morocco—*Limax deshayesii* is recorded by M. Pallary from the environs of Mogador, on the authority of M. Buchet.

Syria—According to Dr. Simroth, the specimens of *Limax flavus* from Syria are exactly similar to those inhabiting Germany or Spain.

NEARCTIC REGION.

Virginia—Lexington, Prof. J. H. Morrison (Cockerell, P.Z.S., 1891, p. 222).

ETHIOPIAN REGION.

Cape Colony—Cape Town (Collinge, Ann. S. African Mus., March 1900, p. 2).

AUSTRALASIAN REGION.

Victoria—Geelong, collected by J. F. Mulder, Oct. 1904 ! Also abundant at East Prahran, Melbourne, Dec. 1904 ! W. Denison Roebuck.

New South Wales—Mosman's Bay, Sydney, April 1905 ! Edgar R. Waite.

New Zealand—Abundant and fine in garden of hotel at Hokitika, Westland, South Island, Jan. 1905 ! W. Denison Roebuck.

Var. **flavescens** Férussac.

The var. *flava* of Wattebled (Journ. de Conch., 1887, p. 309) is identical with this form.

Surrey—Wimbledon, July 1904 ! Mrs. Peck.
Norfolk E.—Strumpshaw Hall, July 1904 ! W. J. O. Holmes.

Dublin—Rathmines, Sept. 1904 !
Wicklow—Enniskerry, Aug. 1904 ! P. H. Grierson.
Kilkenny—Piltown, several, Sept. 1904 ! Earl of Bessborough.

FRANCE.

Sub-var. *flava*, Auxonne, Côte d'Or, and Dôle, Jura (Wattebled, l.c.).

Var. **rufescens** Moquin-Tandon.

Norfolk E.—Strumpshaw Hall, July 1904 ! W. J. O. Holmes.
Huntingdon—Garden, Huntingdon, Sept. 1904 ! Miss E. M. Foster.

Kilkenny—Piltown, Sept. 1904 ! Earl of Bessborough.
Kerry—Kilflynn, Sept. 1904 ! J. Julian.

Var. **virescens** Férussac.

Norfolk E.—Strumpshaw Hall, July 1904 ! W. J. O. Holmes.
Pembroke—A form approaching this variety on the North Cliff near the harbour (A. G. Stubbs, Journ. of Conch., July 1900, p. 322).

Limerick—Adare Manor, Adare, one, adult, Oct. 1904 ! W. Bowles.

Var. **antiquorum** Sowerby.

IRELAND.

Derry—Straidarran, July 1904 ! P. H. Grierson.
Antrim—Ballycastle, Sept. and Oct. 1904 ! Miss F. S. O'Connor.
Tyrone—Baronscourt gardens, Sept. 1904 ! Robert Bell.
Louth—East of Drogheda, Oct. 1904 ! P. H. Grierson.
Kildare—A gigantic adult, Naas, Oct. 1904 ! R. J. Pack-Beresford.
Wicklow—Fassaroe near Bray, Sept. 1904 ! R. M. Barrington.
Carlow—Fenagh House, Bagenalstown, Sept. 1904 ! Denis R. Pack-Beresford.
Kilkenny—Piltown, Sept. 1904 ! Earl of Bessborough.
King's Co.—Gardens, Charleville Forest, Tullamore, Sept. 1904 ! R. McKenna.
Roscommon—Mote Park, Sept. 1904 ! Lord Crofton.
Leitrim—Drumkeeran, Oct. 1904 ! Rev. Joseph Meehan. Bank of old mill-dam, Drumshambo, Sept. 1904 ! James M. Welch.
Clare—Dromoland Castle gardens, Newmarket-on-Fergus, Sept. 1904, J. Carter.
Kerry—Kilflynn, Sept. 1904 ! J. Julian.

Var. **tigrina** Pini.

Cheshire—Cellar of "Estyn," Liverpool road, Chester, Oct. 1903 ! B. Tomlin.

Var. **umbrosa** Philippi.

Norfolk E.—Strumpshaw Hall, July 1904 ! W. J. O. Holmes.

Var. **breckworthiana** Lehmann.

Surrey—Wimbledon, July 1904 ! Mrs. Peck.

Meath—Sub-var. *suffusa*, Duleek, Nov. 1904 ! P. H. Grierson.
Roscommon—Mote Park, Sept. 1904 ! Lord Crofton.

Limax arborum Bouchard-Chantereaux.

Habits and Habitat.—Mr. W. Denison Roebuck, F.L.S., found this species to be common and exclusively a denizen of gardens at the Antipodes, both at Sydney, Melbourne, Geelong, Adelaide, and Wellington.

Reproduction.—The period of reproduction in this species evidently extends over a considerable period. The eggs have been observed as early as January 1904, in Ayrshire, by the Rev. R. Godfrey, and adults, half-grown, and young specimens are also found together early in the year; the younger ones are always the most distinctly marked, and usually become more unicolorous with age.

Affinities.—The *Limax sylvaticus* var. *clypeo-fasciata* of Wattebled (Journ. de Conch., 1889, p. 309) described as rare in the woods at Mouchard, Côte d'Or, is probably really referable to this species.

Variation.—Mr. Roebuck in Australia found all the examples referable in colour to the var. *rosea* Broeck, being of a rich rufous-brown, and yet not conformable to any of the sub-varieties described at pp. 94–95. The majority of the specimens were perfectly unicolorous on the body, while those found at East Prahran, Melbourne, had the second or main band represented by a fine but very distinct and continuous dark line. He supplies me with diagnoses of two new varieties, *efasciata* and *bilineata*.

Geological History.—From old soil of Holocene deposit at Cleeve Hill, Gloucestershire (Hinton & Kennard, Pr. Cott. Nat. F.C., 1904, p. 65).

ENGLAND AND WALES.

Wilts. S.—Longleat Gardens, Warminster, Sept. 1904 ! J. A. Singer.
Dorset—Dr. Russell Wallace's garden, Broadstone, July 1904, T. D. A. Cockerell.
Hants. N.—Liphook, July 1905, Rev. S. Spencer Pearce.
Sussex W.—Near Liphook, July 1905, Rev. S. Spencer Pearce.
Kent W.—Plumstead marshes (Rev. J. W. Horsley, J. of C., Oct. 1906, p. 262).
Surrey—Punch Bowl near Haslemere, E. W. Swanton (C. Pannell, jr., J. of C., Apl. 1902, p. 169). On beeches, Headley lane, Boxhill, Apl. 1886 (T. D. A. Cockerell).
Essex N.—Near Clacton-on-Sea, Sept. 1886, W. Whitwell.
Berks.—Common, Bradfield near Reading, Oct. 1904 ! Rev. E. Peake.
Bucks.—Burnham Beeches, Oct. 1905, H. Wallis Kew.
Suffolk W.—Fornham St. Martin, Oct. 1903 ! W. R. Burrell.
Brecon—Abundant, Erwood, Aug. 1904 ! J. Williams Vaughan.
Radnor—New Radnor, Nov. 1903 ! L. McKarg. Abundant, Aberedw, Aug. 1904 ! J. Williams Vaughan.
Anglesey—Rare in limestone quarry near Llanbadrig Church, July 1895 (C. Oldham, Journ. of Conch., Jan. 1898, p. 87).
Westmorland and Lake Lancs.—Common on rotten stumps, Eggerslack Wood, Grange, Aug. 1897 (R. Standen, Journ. of Conch., Oct. 1898, p. 114).
York S.W.—Field near Well Head, Halifax (J. E. Crowther, Halifax Nat., Aug. 1903, p. 48).

SCOTLAND.

Ayr—Tarbert Hill, under stones and on rocks, Nov. 1903; Gourock Burn; near Gill; Ardneil and Fairlie under bark, Nov. 1903, Rev. R. Godfrey.
Perth Mid.—Glen Ogle, Lochearnhead, June 1904 ! Rev. R. Godfrey. Inver Dunkeld, Sept. 1904 ! C. McIntosh.
Kincardine—Woods about Banchory, Sept. 1904 ! G. Sim.
Easterness—Rothiemurchus forest near Aviemore, Aug. 1904 ! Rev. R. Godfrey.
Cantire—Ronachan, Jan. 1906 ! Rev. R. Godfrey.
Main Argyle—Rocky woods, Barbreck, June 1900; also at Ganavan; on rocks and trees, Dunollie; in Glen Crutten; on rocks at Loch Droighin; and at an altitude of 2,000 feet on Ben Cruachan, July 1900, Rev. R. Godfrey. Abounding in woods behind Oban station; a few at Ardbhan Craigs, under stones, but none on the pine trees; rare on Lismore, Sept. 1892 (Standen and Hardy, J. of Conch., Oct. 1893, p. 268).

Hebrides—Balelone, S. Uist, July 1905. It is also the slug of **St. Kilda**, swarming from sea-level to the highest altitudes, and varying greatly in intensity of colour. After rain it appears in countless numbers on the walls of the village, the grave-yard, and houses; it also frequents the faces of the sheer cliff, down almost to the resting ledges of the guillemot, July 1905, J. Waterston.

IRELAND.

Down—Beech Hill near Newry, July 1904! Prof. R. J. Anderson.

Armagh—Forkhill; Meigh; and near Newry, Dec. 1904, P. H. Grierson.

Monaghan—Castleblaney, Nov. 1903; also type and vars. *bettonii* and *nemorosa* near Carrickmacross, July 1904! P. H. Grierson.

Donegal—Extremely abundant amongst moss on trees in plantation behind the hotel at Portsalon, May 1893 (R. Standen, Journ. of Conch., July 1893, p. 198).

Cavan—Kingscourt, June 1904! P. H. Grierson.

Louth—Dundalk; Omeath; Mellifont Abbey; Collon, May 1904; near Blackhall Demesne, Sept. 1904; Beaulieu, Oct. 1904; Narrow Water and Carlingford, Dec. 1904! also type and var. *bettonii*, Dromiskin, June 1904, P. H. Grierson.

Meath—Drumcondra, July 1904; Stamullen, Oct. 1904; near Slane, Jan. 1905; Bective Abbey and Summerhill, Mch. 1905; Athboy, Apl. 1905; and vars. *bettonii* and *colorata*, Duleek, Nov. 1904, P. H. Grierson.

Kildare—Near Staffan Station, P. H. Grierson.

Wicklow—Greystones, Sept. 1903; and Powercourt, April 1904; Enniskerry, Aug. 1904, P. H. Grierson.

Carlow—Fenagh House, Bagenalstown, Sept. 1904! Denis R. Pack-Beresford.

Kilkenny—Kilkenny, Ballyragget, Callan, and Mullinavat, March 1903, P. H. Grierson.

Queen's Co.—Darrow, P. H. Grierson. Stradbally, Sept. 1904! A. G. Stuart.

King's Co.—Edenderry, Nov. 1905, P. H. Grierson.

Galway W.—Near Clifden, Sept. 1904! W. West. Abundant, Gentian Hill, and Currarevagh, July 1895 (Collier and Standen, J. of Conch., Apl. 1896, p. 178).

Clare—Dromoland Castle gardens near Newmarket-on-Fergus, Sept. 1904! John Carter. Type and sub-var. *maculata*, Lahinch, 1900, P. H. Grierson.

Tipperary N.—Road alongside Lough Derg near Derry Castle, Sept. 1904! G. J. Fogerty.

Tipperary S.—Near Clonmel, P. H. Grierson.

Waterford—The var. *rupicola* is found on the extreme summit of the Reeks, and the type a few hundred feet lower down, Rev. A. H. Delap. Cappoquin, Nov. 1902, P. H. Grierson.

Cork N.—Near Macroom, June 1903, P. H. Grierson.

Kerry—Valentia Island, Sept. 1904! Miss M. J. Delap.

SWITZERLAND.

Recorded from Richisau in Canton Glarus by Herr Blum, and collected at an altitude of 2,700 feet at Promontagno, in the Grisons, by Rev. S. Spencer Pearce.

SCANDINAVIA.

Faroes—According to N. Annandale, it was not uncommon and chiefly in gardens at Thorshavn in July and August 1903, but all immature (W. E. Collinge, Proc. Roy. Soc. Edinburgh, 1904, p. 153).

AUSTRALASIAN REGION.

Australia and New Zealand—This species in the Antipodes is common in gardens, and the specimens are all referable to the two new varieties, *efasciata* and *bilineata*. The distribution in New South Wales, Victoria, South Australia, and New Zealand is given under the varietal headings.

Var. **alba** Taylor.

ANIMAL entirely creamy-white, except the black eye-specks, no trace whatever of body or mantle markings, but the dark internal organs are dimly visible through through the skin.

Aberdeen S.—Near the Botanic Garden, Old Aberdeen! G. Sim.

Var. **subrufa** Le Comte.

Queen's Co.—Sub-var. *pallens*, Stradbally, Sept. 1904! A. G. Stuart.

Var. **rosea** Van den Broeck.

The *Limax sylvaticus* var. *cærulea* Baudon, Cat. Moll. Oise, 1862, p. 10, is according to its author, synonymous with the sub-var. *nemorosa* Baudon.

ENGLAND AND WALES.

Cornwall E.—Sub-var. *nemorosa*, St. Austell, Sept. 1904 ! C. P. Richards.

Denbigh—Sub-var. *nemorosa*, Glyndfrdwy, Vale of Llangollen, Aug. 1904 ! B. Tomlin.

Derby—Sub-var. *nemorosa*, Hathersage and Bakewell (L. E. Adams, Journ. of Conch., vii., p. 77).

SCOTLAND.

Edinburgh—Type and sub-var. *nemorosa*, between Balerno and Bavelaw, Apl. 1890 ! W. Evans.

IRELAND.

Monaghan—Sub-var. *nemorosa*, Carrickmacross, July 1904 ! P. H. Grierson.

Fermanagh—Sub-var. *nemorosa*, Castle Coole, Sept. 1904 ! Hon. C. L. Corry; and Portora, Enniskillen, Oct. 1904 ! J. E. R Allen.

Meath—Sub-var. *colorata*, Duleek, Nov. 1904 ! P. H. Grierson

Carlow—Sub-var. *nemorosa*, Bagenalstown, Sep. 1904 ! Denis R. Pack-Beresford.

Queen's Co.—Sub-var. *nemorosa*, Ballyfin, Maryborough, Oct. 1904 ! Sub-var. *colorata*, Stradbally, Sept. 1904 ! A. G. Stuart.

Leitrim—Sub-var. *nemorosa*, Swiss Valley, Glencar, Aug. 1904 ! A. W. Stelfox and R. Welch ; also Mohill, July 1904 ! P. H. Grierson.

Sligo—Sub-var. *nemorosa*, near Sligo, July 1904 ! R. Welch.

Kerry—Sub-var. *nemorosa*, Valentia Island, Sept. 1904 ! Miss M. J. Delap. Kilflynn, Sept. 1904 ! J. Julian.

Var. nov. **efasciata** Roebuck.

Animal rich and uniform rufous-brown, quite destitute of any bands on the body, even the usual pale mid-area of the back being wanting ; shield banded. Formula 000 000.—W. Denison Roebuck.

Victoria—East Prahran, Melbourne, common in gardens, Apl. 1905 ! W.D.R. Botanical Gardens, Melbourne, Apl. 1905 ! W.D.R. Geelong, common in gardens, Apl. 1905 ! H. G. Roebuck and W.D.R.

New South Wales—Gardens, Annandale, Sydney, March 1905 ! W.D.R. Botanical Gardens, Sydney, March 1905, common ! W.D.R.

South Australia—Adelaide, common in the Botanical Gardens, July 1905 ! Dr. M. Holtze and W.D.R.

New Zealand—Gardens, Wellington, Feb. 1905 ! Miss M. Mestayer and W.D.R.

Var. nov. **bilineata** Roebuck.

Animal as in sub-var. *efasciata*, but with the second or main band on the body represented by a distinct continuous and very fine dark line. Formula 020 020.—W. Denison Roebuck.

Victoria—Common in gardens, East Prahran, Melbourne, Dec. 1904 ! Mrs. J. C. Bleechmore and W.D.R.

Var. **bettonii** Sordelli.

Radnor—Abundant, Aberedw, Aug. 1904 ! J. Williams Vaughan.

IRELAND.

Derry—Straidarran, July 1904 ! P. H. Grierson.

Down—Beech Hill near Newry, July 1904 ! Prof. R. J. Anderson.

Armagh—Acton Glebe, Poyntzpass, Sept. 1904 ! Rev. W. F. Johnson. Tanderagee, Sept. 1904 ! James Rea.

Monaghan—Carrickmacross, July 1904 ! P. H. Grierson.

Tyrone—Baronscourt gardens, numerous, Sept. 1904 ! Robert Bell.

Louth—Dromiskin, June 1904 ! P. H. Grierson.

Meath—Duleek, Nov. 1904, P. H. Grierson.

Carlow—Fenagh House, Bagenalstown, Sept. 1904 ! Denis R. Pack-Beresford.

Kilkenny—Piltown, Sept. 1904 ! Earl of Bessborough. Kilkenny, abundant, Sept. 1904 ! J. White.

Queen's Co.—Sub-var. *carpatica*, Stradbally, Sept. 1904 ! A. G. Stuart.
King's Co.—The gardens, Charleville Forest, Tullamore, Sep. 1904 ! R. McKenna.
Roscommon—Loughglynn, Castlerea, Oct. 1904 ! Hugh Kennedy.
Galway E.—Clonbrock, Sept. 1904 ! Hon. R. E. Dillon.
Clare—Scariff, Sept. 1904 ! N. F. Hibbert. Dromoland Castle gardens near Newmarket-on-Fergus, Sept. 1904 ! John Carter.
Tipperary N.—Road by Lough Derg nr. Derry Castle, Sep. 1904 ! G. J. Fogerty.
Cork S.—Skibbereen, Sept. 1904 ! John J. Wolfe.
Kerry—Valentia Island, Sept. 1904 ! Miss M. J. Delap. With *Geomalacus maculosus*, on tree trunks, north of Lough Caragh, June 1904 ! W. West.

Var. **heynemanni** Bielz.

IRELAND.

Derry—Sub-var. *tigrina*, Straidarran, July 1904 ! P. H. Grierson.
Tyrone—Sub-var. *maculata*, Baronscourt gardens, Sept. 1904 ! R. Bell.
Kilkenny—Sub-var. *maculata*, Piltown, Sept. 1904 ! Earl of Bessborough.
Queen's Co.—Sub-var. *maculata*, Stradbally, Sept. 1904 ! A. G. Stuart.
Clare—Sub-var. *maculata*, Lahinch, 1900, P. H. Grierson ; and in gardens of Dromoland Castle, Sept. 1904 ! J. Carter.
Tipperary S.—Sub-var. *maculata*, St. Thomas's Bridge and Glenabbey ; also sub-var. *submaculata*, Oaklands near Clonmel, Rev. A. H. Delap.
Waterford—Sub-var. *maculata*, Morgan's Glen, Waterford, Rev. A. H. Delap.

Var. **rupicola** Less. & Poll.

The few additional localities adduced for this form confirm it as a northern and western race, with a preference for places of some altitude.

SCOTLAND.

Aberdeen S.—Sub-v. *alpestris*, garden, Rubislaw, Aberdeen, Oct. 1904 ! G. Sim.
Hebrides—Var. *nigra*, at back of Connacher, and at mouth of Avon Mhor, on the Island of Hirta, of the St. Kilda group, July 1905 ! J. Waterston.
Shetlands—Sub-var. *alpestris*, Mossbank, Sept. 1904 ! T. Bowie.

IRELAND.

Monaghan—Sub-var. *alpestris*, Drumreaske, Sep. 1904 ! W. F. de Vismes Kane.
Louth—Sub-var. *alpestris*, east of Drogheda, Oct. 1904 ! P. H. Grierson.
Waterford—Sub-var. *rupicola* occurs only on the very summit of the reeks ; the type is found a few hundred feet lower down the mountain, Rev. A. H. Delap.

Agriolimax agrestis (L.).

Food and Habits.—The omnivorous appetite of this species is confirmed by the observation of Recluz, who has recorded it on the poisonous *Boletus luridus* about Paris, while Mr. E. W. Swanton observed in 1904 that this species in company with *Milax sowerbii* and *Arion hortensis* quite ruined the potato crop at Stour Provost, in Dorset, by burrowing within and devouring the tubers.

In New Zealand, Australia, and Cape Colony, according to the experience of Mr. W. Denison Roebuck, *Agriolimax agrestis* does not appear to have the characteristic milky-slime or very little of it, as the mucus seems clear and transparent until after considerable irritation.

Geological History.—The record by Mansel-Pleydell of this species as a Pliocene fossil in Dorset is incorrect, the deposit at Blashenwell being according to Mr. Kennard, only of Holocene age.

Pleistocene.—Von Ihering records *A. agrestis* from the Pleistocene tufa in French Switzerland.

In Germany Herr Clessin records it fossilized from the alluvial deposits at Pürklgut, the Löess at Kumpsfmühl, and the Pleistocene tufaceous deposits about Regensburg.

Holocene.—From quarry-tip, Cleeve Hill, Gloucestershire ; and also from a section in Tooley street, Middlesex.

IRELAND.

Derry—Straidarran, July 1904 ! P. H. Grierson. Gortness, Sept. 1904 ! D. C. Campbell.

Antrim—Colin Glen near Belfast, June 1884 ! S. A. Stewart. The Manse gardens, Antrim, Sept. 1904 ! W. S. Smith.

Down—Abundant, Beech Hill near Newry, July 1904 ! Prof. R. J. Anderson. Garden, Ormeau Park, Belfast, July 1904 ! A. W. Stelfox.

Armagh—Tanderagee, Sept. 1904 ! J. Rea. Portadown, Oct. 1904 ! W. A. Green. Acton Glebe, Poyntzpass, Sept. 1904 ! Rev. W. F. Johnson.

Monaghan—Drumreaske gardens and park, Sept. 1904 ! W. F. de Vismes Kane. Carrickmacross, July 1904 ! P. H. Grierson.

Tyrone—Omagh, July 1904 ! P. H. Grierson. Gardens, Baronscourt, Sept. 1904 ! R. Bell.

Donegal—Templemore Park, Londonderry, Sept. 1904 ! D. C. Campbell.

Fermanagh—Abundant, Castle Coole, Enniskillen, Sep. 1904 ! Hon. C. L. Corry. Abundant, Brookeborough near Clones, Sept. 1904 ! Sir Douglas Brooke. Belle Isle, Lisbellaw, Sept. 1904 ! Miss Porter-Porter.

Cavan—Cavan, Sept. 1904 ! J. M. Welch. Mullagh, July 1904 ! P. H. Grierson.

Louth—Dromiskin, June 1904 ! and near Drogheda, Oct. 1904 ! P. H. Grierson.

Meath—Drumcondra and Nobber, July 1904 ! P. H. Grierson.

Kildare—Abundant, Lyons, Aug. 1904 ! P. H. Grierson.

Wicklow—Enniskerry, Aug. 1904 ! P. H. Grierson. Abundant, Fassaroe, Bray, Sept. 1904 ! R. M. Barrington.

Carlow—Abundant, Fenagh House, Bagenalstown, Sept. 1904 ! Denis R. Pack-Beresford.

Kilkenny—Abundant, Kilkenny, Sept. 1904 ! J. White. Abundant, gardens, Piltown, Sept. 1904 ! Earl of Bessborough. Clogh and Kilkenny, Apl. 1902 ; Johnstown, May 1902 ; near Waterford, Jan. 1903 ; Thomastown, Powerstown, and Jenkinstown, Feb. 1903 ; type and var. *lilacina*, near Callan, P. H. Grierson.

Queen's Co.—Stradbally, Sept. 1904 ! A. G. Stuart ; and Ballyfin, Oct. 1904 !

King's Co.—Gardens, Charleville Forest, Tullamore, Sept. 1904 ! R. McKenna.

Westmeath—Rosemont, Moate, Sept. 1904 ! Mrs. Nugent.

Longford—Newton Forbes, Sept. 1904 !

Roscommon—Mote Park, Sept. 1904 ! Lord Crofton. Old Fort, Keadue, Sept. 1904 ! J. M. Welch. Loughglynn, Castlerea, Oct. 1904 ! Hugh Kennedy.

Leitrim—Mohill, July 1904 ! P. H. Grierson. Drumkeeran, Oct. 1904 ! Rev. J. Meehan. Bank of old mill-dam, Drumshambo, Sept. 1903 ! James M. Welch.

Mayo E.—Manulla Junction, Sept. 1904 ! W. West.

Mayo W.—The demesne, Westport, Sept. 1904, John O'Callaghan. Dugort, Achill Island, July 1904 ! P. H. Grierson.

Galway W.—Near Clifden, Sept. 1904 ! W. West. Abundant, Kylemore Castle gardens, Sept. 1904 ! W. Comfort.

Galway E.—Abundant in gardens, Clonbrock, Sept. 1904 ! Hon. R. E. Dillon.

Clare—Lahinch, Nov. 1900, P. H. Grierson. Scariff, Sept. 1904 ! N. F. Hibbert. Doonass, Aug. 1904 ! R. A. Phillips. Dromoland Castle gardens near Newmarket-on-Fergus, Sept. 1904 ! J. Carter.

Limerick—About Mungret and Limerick, Sept. 1904 ! G. J. Fogerty. Adare Manor, Adare, Oct. 1904 ! W. Bowles.

Tipperary N.—Ballingarry, May 1903, P. H. Grierson. Roadsides by Lough Derg near Derry Castle, Sept. 1904 ! G. J. Fogerty.

Tipperary S.—Melview near Clonmel, Oct. 1904 ! Mrs. Malcomson.

Cork N.—Youghal, 1902 ; near Macroom, June 1902, P. H. Grierson. Convamore near Ballyhooley, Oct. 1904 ! J. McMiller.

Cork S.—South bank of river Lee near Cork, July 1904 ! Robert Welch. Skibbereen, Sept. 1904 ! John J. Wolfe.

Kerry—Puffin Island, July 1886, Rev. A. H. Delap. Cahirciveen and Valentia Island, Sept. 1904 ! Miss M. J. Delap.

GERMANY.

Recorded for the Island of Heligoland by Pfeffer ; and also for Pyrmont (Hesse, Mal. Bl., 1880, p. 4).

FRANCE.

Recorded for the Lot-et-Garonne by Gassies, and by H. Cardot for the Ardennes.

SWITZERLAND.

Grisons—Obtained by the Rev. S. Spencer Pearce at an altitude of 7,500–8,000 feet at Silvaplana.

AUSTRO-HUNGARY.

Dalmatia—Cited from many localities by Clessin.

NEARCTIC REGION.

Pennsylvania—Leetsdale, Allegheny Co., Jan. 1906, G. H. Clapp.

Colorado—Unusually dark specimens of vars. *rufescens* and *brunnea* at Boulder, Oct. 1904. A few were almost entirely black, with some intermediates ; no sign of light or spotted varieties. This is the first real find in Colorado, the record you give was a single specimen turned loose.—T. D. A. COCKERELL.

New Mexico—Pecos Valley (T. D. A. Cockerell, Nautilus, 1896, p. 35).

ETHIOPIAN REGION.

Cape Colony—Green Point Common, near Cape Town, Nov. 1904 ! W. Denison Roebuck.

AUSTRALASIAN REGION.

Victoria—Abundant at East Prahran, Melbourne, in both the chief forms of *reticulata* and *pallida*, Dec. 1904 ! W. Denison Roebuck.

South Australia—Abundant in Botanical Garden, Adelaide, Dec. 1904 ! W. D. R.

New Zealand—Everywhere in gardens, and under wood and stones ; the vars. *reticulata* and *pallida* common at Paradise, Diamond Lake ; in hotel garden, Hokitika ; at Longford ; and Inangahua Junction. The usual forms and v. *violacea* common in garden, Eye street, Invercargill ; all in the South Island, Jan. 1905, W. D. R.

In the North Island both forms were found at Wairakei ; Waiotapu ; Okere Falls, and banks of Rotorua Lake ; while in Mr. Murdoch's garden, at Wanganui, there were in addition the vars. *violacea* and *nigra*, Feb. 1905 ! W. Denison Roebuck.

Var. **albitentaculata** Dum. & Mort.

Northampton—Haselbeech, Rev. W. A. Shaw.

Antrim—Ballycastle, Oct. 1904 ! Miss F. S. O'Connor.

Kilkenny—Gardens, Piltown, Sept. 1904 ! Earl of Bessborough.

FRANCE.

Near Auxonne, Côte d'Or (Wattebled, Journ. de Conch., 1889, p. 309).

Var. **pallida** Schrenk.

Meath—Sub-var. *albida*, Drumcondra, July 1904, P. H. Grierson.

Wicklow—Enniskerry, Aug. 1904, P. H. Grierson.

Var. **violacea** Gassies.

ENGLAND AND WALES.

Stafford—Sub-var. *lilacina*, Stafford, Lionel E. Adams.

Pembroke—Sub-var. *lilacina*, North Cliff, Tenby (A. G. Stubbs, J. of Conch., July 1900, p. 322).

Derby—Sub-var. *lilacina*, Matlock, J. A. Howe (Rev. H. Milnes, J. of Conch., Oct. 1893, p. 275).

IRELAND.

Armagh—Newry, Dec. 1904, P. H. Grierson.

Donegal—Gardens, Downhill near Londonderry, Sept. 1904 ! C. N. Lynes.

Fermanagh—Abundant, Castle Coole, Enniskillen, Sep. 1904 ! Hon. C. L. Corry.

Dublin—Rathmines, Sept. 1904 !

Kilkenny—Sub-var. *lilacina*, near Callan, P. H. Grierson.

King's Co.—Gardens, Charleville Forest, Tullamore, Sept. 1904 ! R. McKenna. Birr, Sept. 1904 ! Miss A. Hemphill.

Westmeath—Common, Rosemont, Moate, Sept. 1904 ! Mrs. Nugent.

Roscommon—Mote Park, Sept. 1904 ! Lord Crofton. Rockingham gardens near Boyle, Sept. 1904 ! E. Clarke. Loughglynn, Castlerea, Oct. 1904 ! Hugh Kennedy.

Galway E.—Abundant, Clonbrock, Sept. 1904 ! Hon. R. E. Dillon.

Clare—Abundant, gardens, Dromoland Castle near Newmarket-on-Fergus, Sept. 1904 ! J. Carter.

AUSTRALASIAN REGION.

New Zealand—Numerous in garden, Eye street, Invercargill, South Island, Jan. 1905 ! also with var. *nigra* in Mr. Murdoch's garden, Wanganui, North Island, Feb. 1905 ! W. Denison Roebuck.

Var. **rufescens** Dum. & Mort.

NEARCTIC REGION.

United States—Boulder, Colorado, Oct. 1904, T. D. A. Cockerell.

Var. **brunnea** Taylor.

Bucks. — Sub-var. *tristis*, garden, Aston-Clinton, 1900 (A. Leicester, J. of Conch., July 1902, p. 216).

Roxburgh—Jedburgh, Sept. 1904 ! J. Roseburgh.

Kilkenny—Kilkenny, Sept. 1904 ! J. White.

NEARCTIC REGION.

United States—Boulder, Colorado, Oct. 1904, T. D. A. Cockerell.

Var. **punctata** Picard.

ENGLAND.

Surrey—Croydon and Haslemere (C. Pannell, jun., Journ. of Conch., Apl. 1902, p. 169).

FRANCE.

Common about Auxonne and Genlis, Côte d'Or (Wattebled, Journ. de Conch., 1889, p. 310).

Var. **reticulata** Müller.

IRELAND.

King's Co.—Edenderry, Nov. 1905, P. H. Grierson.

Var. **nigra** Morelet.

ENGLAND.

Sussex E.—Garden, Queen's Park road, Brighton, Oct. 1903 ! F. G. S. Branwell.
Stafford—Stafford, Lionel E. Adams.
Radnor—New Radnor, Nov. 1903 ! L. McKarg.
Derby—Clifton (L. E. Adams, Journ. of Conch., vii., p. 77).
Lancashire S.—About Oldham (F. Taylor, J. of Conch., Apl. 1898, p. 50).
Cumberland—Bassenthwaite (W. J. Farrer, Journ. of Conch., Jan. 1896, p. 154).

Orkneys—Stromness, Oct. 1904 ! J. Grant.

IRELAND.

Down—Comber, one, small, Sept. 1904 ! A. W. Stelfox and R. Welch.
Donegal—Portsalon, Kinny Lough, and Fahan, May 1893 (R. Standen, Journ. of Conch., July 1893, p. 198).
Cavan—Cavan, Sept. 1904 ! J. M. Welch.
Meath—Lough Ballyhoe, Apl. 1904 ! P. H. Grierson.
Roscommon—Rockingham gardens near Boyle, Sept. 1904 ! E. Clarke.
Leitrim—Bank of old mill-dam, Drumshambo, Sept. 1904 ! J. M. Welch.
Galway E.—Gardens, Clonbrock, Sept. 1904 ! Hon. R. E. Dillon.

SPAIN AND PORTUGAL.

Spain—*L. panormitanus* var. *ponsonbyi* Hesse, Gibraltar (Heynemann, Jahrb. Deutsch. Mal. Ges., 1885, p. 257).

NEARCTIC REGION.

United States—Boulder, Colorado, Oct. 1904, T. D. A. Cockerell.

AUSTRALASIAN REGION.

New Zealand—Var. *violacea* and the common forms in Mr. Murdoch's garden, Wanganui, North Island, Feb. 1905 ! W. Denison Roebuck.

Agriolimax lævis Müller.

Food and Habits.—Dr. Simroth directs attention to the remarkable resemblance of this species to *Rhynchodesmus terrestris*, which is especially noticeable when the dead leaves and twigs have fallen, but before decay; he, however, does not think this a protective device, but believes the similarity is due to living upon and amongst similar material.

Geological History.—Reported by A. S. Kennard from the Pleistocene beds at Crayford in Essex.

In Bavaria it is recorded by Herr Clessin from the pleistocene tufa near Regensburg, the alluvium at Pürklgut, and the Löess at Galgenburg.

ENGLAND AND WALES.

Devon N.—Belstone near Okehampton, Sept. 1904 ! Rev. W. Wright Mason.

Dorset—Banks of river Lyme, Aug. 1892 ! L. E. Adams.

Hants. N.—Liphook, July 1905, Rev. S. Spencer Pearce. In hedgebanks, under logs, etc., at Beckford Green, Hoe Moor, etc., about Hambledon, C. S. Coles.

Sussex W.—Near Liphook, July 1905, Rev. S. Spencer Pearce.

Berks.—Under logs, Bradfield, Dec. 1905 ! Rev. E. Peake.

Suffolk E.—Mendlesham, Oct. 1904 ! A. Mayfield.

Brecon—Abundant under stones on island in Llangorse Lake, with *Zonitoides nitidus*, April 1905 ! J. Williams Vaughan.

Denbigh—Glyndyfrdwy, Vale of Llangollen, Aug. 1904 ! B. Tomlin.

Anglesey—Fairly common ; wet places on the cliffs and in fields ; the snipe-bog ; and in a wood near Rhos Goch station, July 1895 (C. Oldham, Journ. of Conch., July 1898, p. 87).

Lincoln N.—Blow Wells, Tetney, Apl. 1903 ! H. Wallis Kew.

Derby—Darley Dale and Miller's Dale, R. Standen (Rev. H. Milnes, Journ. of Conch., Oct. 1893, p. 275).

Lancashire S.—Common in clumps of rushes in wet places near Daisy Nook, and in Riversvale near Oldham (F. Taylor, J. of Conch., Apl. 1898, p. 50).

Isle of Man—Douglas, Apl. 1904 (B. R. Lucas, J. of Conch., July 1904, p. 90).

SCOTLAND.

Perth Mid—Glen Ogle, Lochearnhead, June 1904 ! Rev. R. Godfrey.

Aberdeen S.—Banks of river Don near Aberdeen, Sept. 1904 ! G. Sim.

Main Argyle—Oban, Apl. 1894 ! W. Evans. Hill above Taycreggan and banks of burn at Barbreck, June 1900 ; also on banks of Loch Awe, and in Glen Sheilach, July 1900, Rev. R. Godfrey. Ardbhan Craigs, in woods on road to Loch Etive, and about Dunollie Castle ! the commonest slug on Lismore, Sept. 1892 (Standen and Hardy, Journ. of Conch., Oct. 1893, p. 269).

Hebrides—Frequent on the lower parts of Mullachs Mhor and Connacher, Island of Hirta, St. Kilda group, July 1905, J. Waterston.

IRELAND.

Armagh—Armagh, Dec. 1904 ; and Tynon, July 1905, P. H. Grierson. Acton Glebe, Poyntzpass, Sept. 1904 ! Rev. W. F. Johnson.

Monaghan—Carrickmacross, Nov. 1904, P. H. Grierson.

Donegal—Portsalon, Kinny Lough, and Fahan, May 1893 (R. Standen, Journ. of Conch., July 1893, p. 198).

Louth—Carlingford ; Ardee ; Castle Bellingham ; Blackhall Demesne, Sept. 1904 ; Castle Rocke, Dec. 1904 ; and Beaulieu, Oct. 1904, P. H. Grierson.

Meath—Nobber ; Stamullen, Oct. 1904 ; Longwood, Mch. 1903 ; Longwood and Trim, Apl. 1905 ; Moynalty and Kells, Apl. 1905 ; Drogheda, May 1905, P. H. Grierson.

Wicklow—Powerscourt, Apl. 1904 ; and Enniskerry, Aug. 1904 ! P. H. Grierson.

Kilkenny—Near Waterford, Jan. 1903, P. H. Grierson.

Galway W.—About Renvyle and among bogs about Kylemore, Mch. 1891, R. F. Scharff. Dernasliggan, Apl. 1897 (R. Welch, Irish Nat., Nov. 1897, p. 304).

Galway E.—Amongst rushes in marshy ground, Clonbrock, Hon. R. E. Dillon (R. Welch, Irish Naturalist, June 1899, p. 143).

GERMANY.

Thuringia—On banks of Saale at Saalfeld (E. von Martens, Jahrb. Deutsch. Mal. Ges., 1877, p. 226).

ETHIOPIAN REGION.

Cape Colony—Cape Town (Collinge, Ann. S. African Mus., Dec. 1901, p. 234). Queenstown, June 1905 ! Rev. W. J. Dower and W. Denison Roebuck.

AUSTRALASIAN REGION.

New Zealand—Common at Tampo Spa, North Island, Feb. 1905 ! W. Denison Roebuck.

A. lævis campestris var. zonatipes Ckll., Conch., Sept. 1892, p. 72.

ANIMAL blackish-brown, except the paler sides below mantle ; sole with the central area pale and the lateral ones black or blackish, in striking contrast.

NEARCTIC REGION.

United States—On banks of Lake Merced, San Francisco County, California, Mr. Raymond (Cockerell, l.c.).

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Public Library, Hull (W. F. Lawton, Chief Librarian).
F. Rhodes, Cartwright Museum, Bradford.

A. lævis campestris var. occidentalis Cooper.

NEARCTIC REGION.

California—Near the summit of Tehachipi Pass at an altitude of 4,000 feet, May 1885 (J. G. Cooper, Cal. Acad. Sci., 1885, p. 252).

Mr. G. H. Clapp reports the gradual diminution in abundance of *Agriolimax lævis campestris* about Pittsburgh, Pennsylvania, and Cazenovia, New York, this decrease in numbers being apparently correlated with and perhaps due to the increasing abundance of the imported *A. agrestis*, which is now in many places quite the commonest slug of the country, and although in Europe the two species usually occupy different stations, and do not pointedly conflict, yet this distinction may not apply so forcibly in the New World.

GENUS *MILAX* Gray.

Milax gagates (Draparnaud).

ENGLAND.

Cornwall E.—St. Austell, Sept. 1904 ! C. P. Richards.

Devon N.—Belstone, Okehampton, Sept. 1904 ! Rev. W. Wright Mason.

Hants. S.—Very abundant under lettuces and in potato tubers at Hoe Moor, C. S. Coles.

Norfolk W.—King's Lynn, Sept. 1904 ! C. B. Plowright.

Anglesey—Garden, Cemmaes (C. Oldham, J. of Conch., July 1898, p. 86).

Westmorland and Lake Lancs.—Grasmere (W. J. Farrer, J. of Conch., Jan. 1896, p. 154).

Cumberland—Buttermere, Rosthwaite, Keswick, and Bassenthwaite (W. J. Farrer, Journ. of Conch., Jan. 1896, p. 154).

IRELAND.

Monaghan—Carrickmacross, Nov. 1904, P. H. Grierson.

Cavan—Cavan, Sept. 1904 ! J. J. Welch.

Louth—Drumcar; Annagassan; Dromiskin, June 1904 ! and Baltray, July 1904, P. H. Grierson.

Dublin—Near Phœnix Park, Dublin, P. H. Grierson.

Kilkenny—Kilkenny, Apl. 1902; near Waterford, Jan. 1903; Thomastown and Jenkinstown, Feb. 1903; and near Callan, P. H. Grierson.

Roscommon—Mote Park, Sept. 1904 ! Lord Crofton.

Galway W.—Clifden, Connemara, Sep. 1904 ! W. West. Common at Inishmore, Aran Isles, Sept. 1906, R. Standen.

Galway E.—Clonbrock, Sept. 1904 ! Hon. R. E. Dillon.

Limerick—Adare Manor, Adare, Oct. 1904 ! W. Bowles.

FRANCE.

Reported for the departments of the Var, Vaucluse, and Lot et Garonne.

NEARCTIC REGION.

Pennsylvania—This species, though first observed in the Phipps' Conservatory, Schenley Park, Pittsburgh, has now obtained a firm foothold beyond the buildings and is beginning to disperse outside (G. H. Clapp, Oct. 1906).

California—*Milax hewstoni* is undoubtedly increasing in and about gardens, to which situations it is strictly limited, and where it is often very destructive. In 1879 it was discovered by Dr. Anderson at Santa Cruz, though unknown there in 1865. It is still unsettled whether *Limax sandwichensis* is identical (Cooper, Cal. Acad. Sci., 1885, p. 250).

ETHIOPIAN REGION.

Cape Colony—The common slug on all the mountains round Cape Town; Ashton in Robertson district; Storms Valley, Swellendam district; and Signal Hill, Cape Town, F. Purcell (W. E. Collinge, Ann. S. Afr. Museum, Dec. 1901, p. 230). Abundant at Green Point, Cape Town, Nov. 1904 and Sept. 1905 ! W. D. Roebuck.

AUSTRALASIAN REGION.

New Zealand—Type and var. *plumbea* in Mr. Murdoch's garden, Wanganui, North Island, Feb. 1905 ! W. Denison Roebuck.

Var. **plumbea** Moquin-Tandon.

ENGLAND AND WALES.

Devon N.—Belstone, Okehampton, Sept. 1904 ! Rev. W. Wright Mason.
Anglesey—Garden, Cemmaes, July 1895 (C. Oldham, J. of C., July 1898, p. 86).
Derby—Matlock, J. A. Howe (Rev. H. Milnes, J. of Conch., Oct. 1893, p. 275).
York S.E.—Bempton, June 1906 ! J. E. Crowther.
Cumberland –Bassenthwaite (W. J. Farrer, J. of Conch., Jan. 1896, p. 154).

IRELAND.

Armagh—Newry, July 1905, P. H. Grierson.
Louth—Drogheda, July 1904 ! Carlingford, Dec. 1904 ! P. H. Grierson.
Meath—South of Lake Ballyhoe, P. H. Grierson.
Wicklow—Greystones, Sept. 1903, P. H. Grierson. Fassaroe, Bray, Sept. 1904 ! R. M. Barrington.

AUSTRALASIAN REGION.

New Zealand—Hotel garden, Hokitika, South Island, Jan. 1905 ! With type in Mr. Murdoch's garden, Wanganui, North Island, Feb. 1905 ! W. Denison Roebuck.

Var. **rava** Williams.

ENGLAND AND WALES.

Devon N.—Belstone, Okehampton, Sept. 1904 ! Rev. W. Wright Mason.
Surrey—Betchworth, Nov. 1906 ! Lionel E. Adams.
Essex N.—Abundant, but mostly young, near Manningtree, Sept. 1904 ! Rev. Proctor Benwell.
Anglesey—Foot of a wall near Cemmaes, July 1895 (C. Oldham, J. of Conch., July 1898, p. 86).

SCOTLAND.

Berwick—Cockburnspath, Sept. 1890 ! W. Evans.
Perth S. and Clackmannan—Garden, Callander, Sept. 1906 ! W. Evans.

IRELAND.

Antrim—Ballycastle, Oct. 1904 ! Miss F. S. O'Connor.
Armagh—Tandragee, Sept. 1904 ! J. Rea.
Donegal—Gardens, Downhill near Londonderry, Sept. 1904 ! C. N. Lynes.
Fermanagh—Castle Coole, Enniskillen, Sept. 1904 ! Hon. C. L. Corry. Portora, Enniskillen, Oct. 1904 ! J. E. R. Allen.
Meath—Julianstown, Apl. 1905, P. H. Grierson.
Kildare—Naas, Oct. 1904 ! R. J. Pack-Beresford.
Wicklow—Fassaroe, Bray, Sept. 1904 ! R. M. Barrington.
Kilkenny—Kilkenny, Sept. 1904 ! J. White.
King's Co.—Charleville Forest gardens, Tullamore, Sept. 1904 ! R. McKenna.
Westmeath—Moate, Sept. 1904 ! Mrs. Nugent.
Galway W.—Kylemore Castle gardens, Sept. 1904 ! W. Comfort.
Galway E.—Clonbrock, Sept. 1904 ! Hon. R. E. Dillon.
Clare—Woodpark, Scariff, Sept. 1904 ! N. F. Hibbert.
Limerick—Limerick, Sept. 1904 ! G. J. Fogerty.
Kerry—Valentia Island, Sept. 1904 ! Miss M. J. Delap.

Var. **pallidissima** Pollonera.

Cornwall W.—Near Stenalee, Sept. 1904 ! C. P. Richards.

Milax sowerbii (Férussac).

ENGLAND.

Cornwall W.—Near Stenalee, Sept. 1904 ! C. P. Richards.

Cornwall E.—St. Austell, Sept. 1904 ! C. P. Richards.

Dorset—Stour Provost, Sept. 1904 ! (Swanton, J. of Conch., Jan. 1905, p. 286).

Hants. S.—Common in gardens, Hambledon, C. S. Coles.

Sussex E.—Garden, Queen's Park road, Brighton, Oct. 1903 ! F. G. S. Branwell.

Kent E.—Maidstone (Elgar and Lamb, Journ. of Conch., Jan. 1893, p. 154).

Surrey—Garden, South Norwood, A. Reynell. Very common in gardens, Haslemere (C. Pannell, junr., Journ. of Conch., July 1903, p. 331). Garden, Wimbledon, July 1904 ! Mrs. Rock.

Hunts.—Garden, Huntingdon, Sept. 1904 ! Miss E. M. Foster.

Gloucester E.—Argyll House, Cirencester, Aug. 1904 ! Mrs. Blundell.

Hereford—Common in garden, Broomy Hill, Hereford, Sept. 1904 ! Miss M. A. Boycott ; and also in garden, Acacia Villa, Ross, Sept. 1904 ! W. C. Blake.

Pembroke—Abundant, Haverfordwest, Sept. 1904 ! Price Davies.

Carmarthen—Near Llanelly, Sept. 1904 ! H. Rowland Wakefield.

Westmorland and Lake Lancashire—Grasmere (W. J. Farrer, Journ. of Conch., Jan. 1896, p. 154).

Cumberland—Not uncommon in woods near Keswick and Braithwaite ; a specimen in Sir Wilfrid Lawson's woods at Bassenthwaite (W. J. Farrer, J. of Conch., Jan. 1896, p. 154).

SCOTLAND.

Selkirk—Byethorn garden, Galashiels, Sept. 1906 ! John Roseburgh.

IRELAND.

Antrim—Ballycastle, Sept. 1904 ! Miss F. S. O'Connor. Antrim, in fields and gardens, Sept. 1904 ! W. S. Smith.

Down—Common in Mr. Stelfox's garden, Oakleigh, Belfast ! R. Welch.

Armagh—Tandragee, common, Sept. 1904 ! James Rea.

Tyrone—Baronscourt, Sept. 1904 ! Robert Bell.

Donegal—Rare, Kinny Lough, May 1893 (R. Standen, J. of C., July 1893, p. 198).

Louth—Bultray ; Drumcar ; Millifont Abbey ; Barmeath, June 1904 ; Ardee and Drogheda, July 1904 ; near Blackhall Demesne, Sept. 1904 ! and Carlingford, June 1905, P. H. Grierson.

Meath—Mornington, Oct. 1904 ; Bective Abbey and near Drogheda, Mar. 1905 ! P. H. Grierson.

Dublin—Beldonnell, P. H. Grierson.

Wicklow—Abundant, Fassaroe, Bray, Sep. 1904 ! R. M. Barrington. Greystones, Sept. 1903 ; type and var. *rustica*, Enniskerry, Aug. 1904 ! P. H. Grierson.

Carlow—Abundant, Fenagh House, Bagenalstown, Sept. 1904 ! Denis R. Pack-Beresford.

Kilkenny—Kilkenny, April 1902 ! and Thomastown, Feb. 1903, P. H. Grierson. Abundant, Kilkenny Castle gardens, Sept. 1904 ! John Carlton. Gardens, Piltown, Sept. 1904 ! Earl of Bessborough.

Queen's Co.—Stradbally, Sept. 1904 ! A. G. Stuart.

King's Co.—Birr, Sept. 1904, Miss A. Hemphill ; Edenderry, Nov. 1905, P. H. Grierson. Plentiful, Charleville Forest gardens, Tullamore, Sep. 1904 ! R. McKenna.

Roscommon—Abundant, Mote Park, Sept. 1904 ! Lord Crofton. Rockingham gardens, Boyle, Sept. 1904 ! E. Clarke.

Leitrim—Drumkeeran, Oct. 1904 ! Rev. Joseph Meehan.

Mayo W.—Abundant, the Demesne, Westport, Sept. 1904 ! John O'Callaghan.

Galway W.—Abundant, Kylemore Castle gardens, Sept. 1904 ! W. Comfort. Also extremely abundant and very large near the outskirts of Galway town ; eight or ten specimens might be found under one stone, Sept. 1906, R. Standen.

Galway E.—Clonbrock, Sept. 1904 ! Hon. R. E. Dillon. Abundant at Ballindooly, Sept. 1906, R. Standen.

Waterford—Dunmore, Jan. 1903, P. H. Grierson.

Clare—Lahinch, 1900, P. H. Grierson. Dromoland Castle gardens near Newmarket-on-Fergus, Sept. 1904 ! John Carter. Abundant between Limerick and the Clare Hills, Sept. 1904 ! G. J. Fogerty.

IRELAND.

Limerick—Adare Manor, Adare, Oct. 1904 ! W. Bowles. Round Murgret, and near Limerick, Sept. 1904 ! G. J. Fogerty.

Tipperary S.—Melview, Clonmel, Oct. 1904 ! Mrs. M. Malcomson.

Cork N.—Convamore by Ballyhooley, Oct. 1904 ! J. McMillar.

Kerry—Cahirciveen, Sept. 1904 ! and plentiful on Valentia Island, Sept. 1904 ! Miss M. J. Delap.

FRANCE.

Reported for the Vaucluse by Commandant Caziot.

Var. **pallidissima** Less. & Poll.

ENGLAND AND WALES.

Flint—Sub-var. *insolita*, Grange road, Rhyl, July 1904 ! Miss A. Steele Perkins.

Cheshire—Var. *pallidissima*, Chester, Sept. 1904, R. Newstead (T. D. A. Cockerell).

IRELAND.

Kerry—Sub-var. *flavescens*, Kilflynn, Sept. 1904 ! J. Julian.

Var. **fusco-carinata** Cockerell.

IRELAND.

Kerry—Kilflynn, Sept. 1904 ! J. Julian.

Var. **rustica** Roebuck.

ENGLAND.

Surrey—Garden, Reigate, Aug. 1903, Lionel E. Adams.

IRELAND.

Wicklow—Enniskerry, Aug. 1904 ! P. H. Grierson.

FRANCE.

The var. *rustica* Moquin-Tandon is recorded for the department of the Ardennes by M. Henri Cardot.

Var. **nigrescens** Cockerell.

ENGLAND AND WALES.

Hunts.—Garden, Huntingdon, Sept. 1904 ! Miss E. M. Foster.

Pembroke—Haverfordwest, Sept. 1904 ! Price Davies.

Hereford—Garden, Broomy Hill, Hereford, Sept. 1904 ! Miss M. A. Boycott ; garden, Acacia Villa, Ross, Sept. 1904 ! W. C. Blake.

IRELAND.

Tyrone—Sub-var. *nigro-carinata*, Baronscourt, Sept. 1904 ! R. Bell.

Donegal—Templemore Park, Sept. 1904 ! D. C. Campbell.

Louth—Near Drogheda, Oct. 1904 ! P. H. Grierson.

Dublin—Rathmines, Sept. 1904 !

Wicklow—Var. *nigrescens* and sub-var. *nigro-carinata*, Fassaroe, Bray, Sept. 1904 ! R M. Barrington.

Kilkenny—Kilkenny, Sept. 1904 ! J. White.

Queen's Co.—Sub-var. *nigro-carinata*, Stradbally, Sept. 1904 ! A. G. Stuart.

Clare—Between Limerick and the Clare Hills, Sept. 1904 ! G. J. Fogerty.

Limerick—Sub-var. *nigro-carinata*, near Limerick, Sept. 1904 ! G. J. Fogerty.

Waterford—Sub-var. *nigro-carinata*, garden, Belle Vue House, Waterford, Sept. 1904 ! Frederick Power.

Cork N.—North bank of river Lee, Cork, Sept. 1904 ! C. Baker. Sub-var. *nigro-carinata*, Convamore by Ballyhooley, Sept. 1904 ! J. McMillar.

FAMILY ARIONIDÆ Gray.

GENUS *ARION* Férussac.

Dr. Simroth suggests that a more satisfactory basis for the classification of this group might be afforded by the differences in the length of the epiphallus, an organ which seems to possess great constancy in this respect in the various species.

The external markings on the body are directly connected with the circulation of the blood, and the lyre-shaped marking on the shield is coincident in form with the lung, which lies beneath in the form of a ring. As the dark markings on the mantle are dependent on the circulation of the blood during the respiratory processes, one may conclude that the dark markings on the side-areas are used for skin respiration. This is probably, however, less likely in the larger species, on account of their thicker skin and greater secretion of coloured slime, so that the correlation of circulation and markings is not so marked.

Arion ater (L.).

Food and Habits.—Young *Arion ater* are often found on *Allium ursinum* in the neighbourhood of Leipzig.

Var. **aterrima** Taylor.

The name of *aterrima* has been objected to, as having been previously used by Dumont and Mortillet, but this is not so, as those authors do not appear to have described any variation under that name.

Var. **castanea** Dum. & Mort.

ENGLAND AND WALES.

Kent W.—Sub-var. *fusco-lutescens*, Chislehurst, T. D. A. Cockerell.

Berks.—Unhill Wood near Streatley, July 1906 ! Rev. E. Peake.

Anglesey—Sub-var. *brunnea*, common, Cemmaes, July 1895 (C. Oldham, Journ. of Conch., July 1898, p. 86).

Lancashire S.—Sub-var. *brunnea*, near Oldham (F. Taylor, Journ. of Conch., April 1898, p. 49).

York S.E.—Sub-var. *brunnea*, Aldborough, T. Petch.

IRELAND.

Antrim—The Manse, Antrim, Sept. 1904 ! W. S. Smith.

Armagh—Sub-var. *brunnea*, Forkhill, Jan. 1904, and Armagh, Feb. 1904, P. H. Grierson.

Louth—Sub-var. *brunnea*, near Carlingford, P. H. Grierson.

Meath—Sub-var. *brunnea*, Bective Abbey, March 1905 ; Moynalty and Kells, April 1905, P. H. Grierson.

Wicklow—Sub-var. *brunnea*, Greystones, Sept. 1903, P. H. Grierson.

Galway W.—Dernasliggan, April 1897, R. Welch ; this locality is erroneously stated to be in East Galway (p. 178). Type and sub-var. *brunnea*, abundant, Gentian Hill, July 1895 (Collier and Standen, J. of Conch., April 1896, p. 178).

Galway E.—Killinure, Lough Ree, Sept. 1906, R. Standen.

Clare—Near Limerick, Sept. 1904 ! G. J. Fogerty.

Var. **plumbea** Roebuck.

ENGLAND.

Sussex W.—Near Liphook, July 1905, Rev. S. Spencer Pearce.

Derby—Rowsley (Lionel E. Adams, Journ. of Conch., vii., p. 77).

York Mid W.—Addingham, Aug. 1906 ! F. Booth. Grass Wood, Grassington, Sept. 1906 ! S. Hainsworth.

IRELAND.

Meath—Moynalty, April 1905, P. H. Grierson.

Galway W.—A slate-grey form, probably *plumbeo-pallescens*, at Inishmore, Aran Isles, Sept. 1906, R. Standen.

Var. **rufa** L.

ENGLAND.

Cornwall W.—In large numbers and of huge size in company with typical *ater* in a marsh between Penzance and St. Michael's Mount, June 1905, J. H. Sikes.

Surrey—Var. *rufa*, Grayswood, and sub-var. *jonstonii* Kalenicz., Punch Bowl near Haslemere, E. W. Swanton (C. Pannell, jr., J. of Conch., Apl. 1902, p. 169).

Cumberland—About Bassenthwaite (W. J. Farrer, Journ. of Conch., Jan. 1896, p. 153).

IRELAND.

Clare—Gardens near Limerick, Sept. 1904 ! G. J. Fogerty.

Limerick—Limerick, Sept. 1904 ! G. J. Fogerty.

GERMANY.

Baden—Woods about Freiburg (W. Evans).

BELGIUM.

Sub-var. *rubra*, Brussels, J. T. Carrington.

Var. **succinea** Müller.

ENGLAND.

Berks.—Very young specimens, Bradfield, Dec. 1905 ! Rev. E. Peake.

Westmorland and Lake Lancs.—Sub-var. *aurantia*, Arnside, 1906, H. Beeston.

SWITZERLAND.

Lucerne (Bourg., Mal. Quatre-Cantons, 1862, p. 1).

Var. **alba** L.

ENGLAND.

Kent E.—Maidstone (Elgar and Lamb, Journ. of Conch., Jan. 1893, p. 154).

Surrey—Punch Bowl near Haslemere, E. W. Swanton ; and Shottermill (Chas. Pannell, jr., Journ. of Conch., April 1902, p. 169).

Lancashire Mid—Silverdale, May 1904, J. W. Jackson.

York S.W.—Brearley Wood near Halifax, Oct. 1906 ! W. Cash.

IRELAND.

Galway E.—A pale bluish-white form, with cream-white marblings and yellow foot-fringe, abundant at Ballindooly, Sept. 1906, R. Standen.

Var. **albolateralis** Roebuck.

Prof. Cockerell suggests that the specimens of var. *albolateralis*, found by Mr. E. D. Marquand at Penzance, in Sept. 1885, in which the foot-fringe was grey in place of yellow, should be known as sub-var. *marquandi*.

ENGLAND AND WALES.

Cornwall W.—The Lizard, June 1905, F. W. Wilson.

Merioneth—Glandawr, Dolgelly road, Barmouth, June 1905 ! Rev. E. Percy Blackburn.

Carnarvon—Abersoch, June 1896, C. Oldham, J. of Conch., Oct. 1898, p. 263.

Notts.—Four specimens under a log, Thoresby Park, Edwinstone, June 1906, J. Ray Hardy.

York S.E.—Bempton Cliffs, June 1906 ! J. E. Crowther.

IRELAND.

Meath—Ballivor, March 1904, P. H. Grierson.

Galway E.—Killinure and Coolagh, Sept. 1906, R. Standen.

Var. **bicolor** Roebuck.

WALES.

Merioneth—Sub-var. *scharffi*, Glandawr, Dolgelly road, Barmouth, June 1905 ! Rev. E. Percy Blackburn.

IRELAND.

Galway E.—Clare-Galway Abbey, July 1895, R. Standen ; this locality is not in West Galway as stated at p. 186.

Var. **marginella** Schranck.

ENGLAND.

Surrey—Sub-var. *swammerdamii*, Punch Bowl near Haslemere, and sub-var. *marginata*, Haslemere, E. W. Swanton (C. Pannell, jr., J. of C., Apr. 1902, p. 169).
Lancashire S.—Sub-var. *nigrescens* Raz., Northen Etchells near Manchester, May 1885 ! C. Oldham.

SCOTLAND.

Lanark—Sub-var. *nigrescens* Raz., Blackwood, Kirkmuirhill, Sep. 1904 ! Norman B. Kinnear.

IRELAND.

Cavan—Sub-var. *nigrescens*, Mullagh, July 1904 ! P. H. Grierson.
Dublin—Sub-var. *nigrescens*, Glen Druid, Carrickmines, Oct. 1886 ! W. F. de Vismes Kane.
Sligo—Sub-var. *nigrescens*, near Sligo, July 1904 ! R. Welch.
Clare—Sub-var. *nigrescens*, near Limerick, Sept. 1904 ! G. J. Fogerty.

Arion subfuscus (Draparnaud).

Synonymy.—According to Mons. H. Crosse (Journ. de Conch., Oct. 1893, p. 219), this species is the *Arion incommodus* of Capt. Hutton.

Food and Habits.—Capt. W. J. Farrer has observed this species to abound in all the low-lying meadow lands bordering the English lakes, and has seen them congregated in large numbers, feeding on the remains of a dead frog, and states that in the lake district the entrances to the burrows of the water-rat are sometimes fairly lined with the sub-var. *aurantiaca*, probably feeding on the droppings of the animals.

ENGLAND AND WALES.

Devon N.—Wood at Mortehoe, Oct. 1906 ! Mrs. Longstaff.
Surrey—Addington (C. Pannell, jr., Journ. of Conch., July 1903, p. 331).
Hants. S.—Frequent about Hambleton ! C. S. Coles.
Berks.—Bradfield near Reading, Rev. E. Peake, Dec. 1906.
Anglesey—Rare, Cemmaes, July 1895 (C. Oldham, J. of Conch., July 1898, p. 86).
Lancashire S.—Type and a pale form on and near canal-bank at Bardsley and Riversvale (F. Taylor, Journ. of Conch., April 1898, p. 49).
York S.E.—Banks of canal, Driffield, J. Darker Butterell.

SCOTLAND.

Ross W.—Common in the woods, Balmacarra, Aug. 1906 ! Rev. R. Godfrey.

IRELAND.

Donegal—Port Salon and Kinny Lough, May 1893 (R. Standen, Journ. of Conch., July 1893, p. 197).
Cavan—Kingscourt, June 1904, P. H. Grierson.
Meath—Nobber, March 1904, P. H. Grierson.
Galway E.—Abundant at Ballindooly, Sept. 1906, R. Standen.

GERMANY.

Reported by Dr. von Martens for Dolmar, Reinhardsbrunn, etc., in Thuringia.

FRANCE.

Recorded for the Lot-et-Garonne by Gassies, the Vaucluse by Commandant Caziot, and Puy-de-Dôme by Dr. P. Fischer.

Var. **succinea** Bouillet.

Cumberland—The sub-var. *aurantiaca* is the most prevalent form about Bassenthwaite (W. J. Farrer, Journ. of Conch., Jan. 1896, p. 153).

Galway E.—Sub-var. *aurantiaca*, Clare-Galway Abbey, July 1895 (Collier and Standen, Journ. of Conch., April 1896, p. 178).

Arion hortensis Férussac.

Food and Habits.—During Sept. 1906, at Moycullen and beside Ross Lake, W. Galway, Mr. R. Standen observed this usually strictly geophilous species ascending the trees to a considerable height, and in Aug. 1898 noted examples feeding upon *Phallus impudicus* and other fungi in Eggerslack Wood, Grange, Lancashire; while Mr. H. Beeston remarks that in autumn it has a strong preference for hiding beneath and clinging to the fallen and decaying leaves of the sycamore.

Geological History.—Calcareous particles, assumed to be the vestigial shells of this species, have been found in a Holocene deposit at Cleeve Hill, East Gloucestershire.

ENGLAND AND WALES.

Dorset—Stour Provost, Sept. 1904 (E. W. Swanton, J. of C., Jan. 1905, p. 286).
Hants. S.—Common everywhere about Hambledon, C. S. Coles.
Kent E.—Maidstone (Elgar and Lamb, Journ. of Conch., Jan. 1893, p. 154).
Essex S.—Wanstead and Barkingside, not common (W. Crouch, Essex Nat., Feb 1891, p. 208).

SCOTLAND.

Main Argyle—Pine woods, Ardbhan Craigs, also plentiful on Lismore, Sept. 1892 (Standen and Hardy, Journ. of Conch., Oct. 1893, p. 268).
Ross W.—Balmacarra House, Aug. 1906 ! Rev. R. Godfrey.

IRELAND.

Donegal—Not uncommon in wood, Portsalon, and in burial-ground at Fahan, May 1893 (R. Standen, Journ. of Conch., July 1893, p. 197).
Cavan—Kingscourt, June 1904, P. H. Grierson.
Meath—Nobber, March 1904, P. H. Grierson.
Queen's Co.—Durron, May 1903, P. H. Grierson.
Galway W.—Moycullen and banks of Ross Lake, Sept. 1906, R. Standen.
Galway E.—Very abundant at Ballindooly, Sept. 1906, R. Standen.

GERMANY.

Recorded by Dr. von Martens for Saalfeld, Liebenstein, etc., in Thuringia.

FRANCE.

Recorded for the Var and Lot-et-Garonne.

SWITZERLAND.

Recorded from the environs of Lucerne, and from Perroy in Canton Vaud.

ALGIERS.

Recorded doubtfully for Algiers by Mr. W. E. Collinge.

NEARCTIC REGION.

Pennsylvania—Though first reported along with *L. maximus* from the Phipps' Conservatories, Schenley Park, Pittsburgh, both species seem now to have obtained a firm foothold outside; the largest *L. maximus* I ever saw was found in a suburb about three miles from the city (G. H. Clapp, Oct. 1906).

Var. **fasciata** Moquin-Tandon.

ENGLAND.

Stafford—About Cheddleton and Froghall, Sept. 1885 (T. D. A. Cockerell, Nat., Feb. 1886, p. 58).

Cheshire—Knutsford, Chelford and Congleton, Sep. 1885 (T. D. A. Cockerell, l.c.).

Lancashire S.—About Prescot and Rainhill, Sep. 1885 (T. D. A. Cockerell, l.c.).

Var. **grisea** Moquin-Tandon.

Stafford—Near Kingsley, Sept. 1885 (T. D. A. Cockerell, Nat., Feb. 1886, p. 58).

Galway W.—A sub-variety, almost white upon the back, at Inishmore, Aran Isles, Sept. 1906, R. Standen.

Var. **subfusca** C. Pfeiffer.

Cheshire—Gardens at Sale (Milne and Oldham, J. of Conch., Jan. 1894, p. 316).

Arion circumscriptus Johnston

Food and Habits. Observed by Mr. R. Standen, in August 1898, feeding on *Phallus impudicus* and other fungi in Eggerslack Wood, Grange, Lancashire.

ENGLAND AND WALES.

Hants. S.—Frequent about Hambledon ! C. S. Coles.

Berks.—Unhill Wood near Streatley, July 1906 ! Rev. E. Peake.

Bucks.—Garden, Aston Clinton, 1900 (A. Leicester, Journ. of Conch., July 1902, p. 216).

Merioneth—Gardens, Palé, Corwen, May 1887 ! T. Ruddy; and Llwyngwril near Barmouth, June 1887 ! W. Cash.

Denbigh—Elwy Valley, St. Asaph, April 1896, C. Oldham.

Anglesey—In fields near Cemmaes, July 1895 (C. Oldham, Journ. of Conch., July 1898, p. 86).

Lincoln N.—Common about Market Rasen. Oct. 1906 ! W. Denison Roebuck.

York Mid W.—Grass Wood, Grassington, Sept. 1906 ! S. Hainsworth.

Westmorland and Lake Lancashire—Eggerslack Wood, Grange, Aug. 1898 (R. Standen, Journ. of Conch., Oct. 1898, p. 114).

SCOTLAND.

Main Argyle—Oban, April 1894 ! W. Evans.

Ross W.—Adult specimens, Balmacarra, Aug. 1906, Rev. R. Godfrey.

IRELAND.

Down—Near Newry, Dec. 1904, P. H. Grierson.

Armagh—Meigh; Armagh, Dec. 1904; Newry and Forkhill, July 1905, P. H. Grierson.

Monaghan—Carrickmacross, P. H. Grierson.

Donegal—Common at Portsalon and Kinny Lough, May 1893 (R. Standen, Journ. of Conch., July 1893, p. 198).

Cavan—Kingscourt, June 1904, and Mullagh, July 1904, P. H. Grierson.
Louth—Omeath; Drumcar; Annagarron; Ardee; Millifont Abbey; Beaulieu, Oct. 1903; Barmeath and Dromiskin, June 1904; Blackhall Demesne, Sept. 1904; and Louth, Nov. 1904, P. H. Grierson.
Meath—Nobber, March 1904; Slane and Drumcondra, July 1904; Stamullan, Oct. 1904; Summerhill and Ballivor, March 1905; Moynalty, Julianstown, and Kells, April 1905; and Batterstown, May 1905, P. H. Grierson.
Kildare—Staffan, P. H. Grierson.
Wicklow—Greystones, Sept. 1903, and Powerscourt, P. H. Grierson.
Kilkenny—Clogh; near Callan; Powerstown; Kilkenny, April 1902; Johnstown, May 1902; near Waterford, Jan. 1903; Thomastown, March 1903; and Jenkinstown, Feb. 1903, P. H. Grierson.
Queen's Co.—Durron, May 1903, P. H. Grierson.
King's Co.—Ruins at Clonmacnois, July 1895 (Collier and Standen, Journ. of Conch., July 1898, p. 86).
Westmeath—Raharney, March 1905, P. H. Grierson.
Leitrim—Feenagh, 1899, P. H. Grierson.
Waterford—Cappoquin, Nov. 1902; Dunmore, Jan. 1903, P. H. Grierson.

RUSSIA.

Recorded by Heynemann for Niankow, Great Minsk (Jahrb. Deutsch. Mal. Ges., 1885, p. 249).

Var. **leucophæa** Normand.

NETHERLANDS.

Belgium—Chaudfontaine and Forest, Liége, June 1871 (Van den Broeck, Bull. Soc. Mal. Belg., 1871, p. 51).

Sub-Genus *Ariunculus* Lessona.

Arion intermedius Normand.

Development.—Mr. F. Booth and Mr. W. Denison Roebuck found the young of this species in great abundance, apparently only just hatched, in the woods on Otley Chevin, Yorkshire, in the middle of October 1906, the species being perfectly recognizable even in the tiniest examples.

Food and Habits.—Mr. W. Denison Roebuck observed this species abundantly in August 1906, in Waterfall and Kildale Woods near Guisborough, feeding freely on the underside of *Boletus flavus*; while in May 1905, at Silverdale in Mid-Lancashire, Mr. J. W. Jackson detected a specimen inside the flower of *Oxalis*, possibly unwittingly contributing to ensure its fertilization.

ENGLAND AND WALES.

Surrey—Oxshott, feeding on *Boletus*, Oct. 1906 ! A. Sich.
Hants. S.—Frequent amongst rubbish and under logs about Hambledon ! C. S. Coles.
Berks.—Common about Bradfield near Reading, Rev. E. Peake, Dec. 1906.
Radnor—Pen-y-Bont, Nov. 1903 ! F. Hall.
Denbigh—Elwy Valley, St. Asaph, April 1896, C. Oldham.
Anglesey—Plentiful in a wet place on the cliffs near Cemmaes, July 1895 (C. Oldham, Journ. of Conch., July 1898, p. 86).
Lincoln S.—Little Ponton, July 1903 ! W. Denison Roebuck.
Lincoln N.—Woodhall Spa, Aug. 1893, F. W. Fierke. Very abundant about Louth (C. S. Carter, Moll. Lincolns., 1905, p. 35).
Lancashire S.—Park Bridge, Feb. 1903, F. Taylor.

York S.E.—North Grimston ; Weltondale ; Drewtondale ; North Cave and in ravine at Filey ; also not uncommon at Hornsea and amongst moss and dead leaves in marshy places at Roos Bog ; Bale Wood ; Aldborough ; Tansterne ; Hedon ; Kelsey Hill and Spurn (T. Petch, Moll. of East Riding, 1904, p. 130).

York N.E.—Waterfall and Kildale Woods, Guisborough, Aug. 1906 ! W.D.R.

York Mid W.—Grass Wood, Grassington, Sept. 1906 ! F. Booth. Rare, Burt Bridge, Sept. 1887, F. R. Fitzgerald.

SCOTLAND.

Perth N.—Persie Inn, Glenshee ! W. Evans.

Ebudes N.—Isle of Eigg ! W. Evans.

Ross W.—Balmacarra, Aug. 1906, Rev. R. Godfrey.

IRELAND.

Down—Near Newry, Dec. 1904, P. H. Grierson.

Armagh—Common in Ford Wood, Tandragee (Irish Nat., July 1906, p. 175).

Louth—Ardee ; Drumcar ; Annagarron ; Blackhall Demesne and Collon, Sept. 1904 ; Beaulieu, Oct. 1904 ; and near Townley Hall, May 1905, P. H. Grierson.

Meath—Nobber, July 1904 ; Stamullen, Oct. 1904 ; Longwood, March 1905 ; and Batterstown, May 1905, P. H. Grierson.

Kildare—Staffan and Lyons, Aug. 1904, P. H. Grierson.

Wicklow—Powerscourt, Nov. 1904, P. H. Grierson.

King's Co.—Edenderry, Nov. 1905, P. H. Grierson.

Leitrim—Near Cloonee, Dec. 1899, P. H. Grierson.

Galway W. — Marvellously abundant in a small wood beyond Dog's Bay, Roundstone, Sept. 1906, R. Standen.

Galway E.—Abundant at Ballindooly, Sept. 1906, R. Standen.

SWITZERLAND.

Old fir-wood near Lucerne, Sept. 1902, Rev. R. Godfrey.

Var. **plumbea** Collinge.

Surrey—Brockham, Nov. 1906 ! Lionel E. Adams.

GENUS *GEOMALACUS* Allman.

Geomalacus maculosus Allman.

Kerry—Miss M. J. Delap records (Irish Naturalist, Aug. 1906, p. 190) finding specimens in June 1906 amongst old ruins on the west face of Bolus Head, and in similar situations on the eastern slope of Kilkeeneragh Mountains near the pass between that mountain and Killemlough Hill.

ADDENDUM.

L. maximus var. bicolor Taylor.

A reference to Am Stein's description of his *Limax cinereus* var. *albus* discloses that this form is not synonymous with the var. *candida* L. & P., as tentatively suggested on page 41, but is really identical with the var. *bicolor*.

Two examples found in a cold and damp garden at Louth in Lincolnshire by Mr. C. S. Carter ; one of them, found in July 1906, is very characteristic and exactly corresponds with the fig. 5 on plate vi. !

LITERATURE.

Works which in addition to those on page 30 may be profitably consulted.

Adams, L. E.—Observations on the Pairing of Limax maximus L.—Journ. of Conch., July 1898, pp. 92—95, and pl. ii.

Alder, Joshua.—A Catalogue of the Mollusca of Northumberland and Durham. —Trans. Tynes. Nat. Field Club, 1848.

Allman, G. J.—Description of a New Genus of Pulmonary Gastropod.—Ann. and Mag. Nat Hist., 1846, xvii.

Am Stein, J. G.—Beiträge zur Mollusken-Fauna Graubünden's, 1889—1892.

André, E.—La Fossette triangulare caudale des Arions.—Rev. Suisse et Ann. Mus. Hist. Nat. Geneva, 1898, pp. 179—182 and fig.

Recherches sur la Glande pédieuse des Pulmonés.—Rev. Suisse de Zool., 1894, pp. 291—348.

Ashford, C.—Land and Freshwater Mollusca round Christchurch, South Hants. —Journ. of Conch., Jan. 1887, p. 153.

B., J.—Spinning Slugs.—Loudon's Mag. Nat. Hist., ii., p. 485, Nov. 1829.

Babor, J. F.—Ueber den Cyclus der Geschlechtsentwicklung der Stylommatophoren.—Verh. Deutsch. Zool. Ges., 1894, pp. 55—61, and figs.

Baudon, Aug.—Mémoire sur les Limaciens du Département de l'Oise Beauvais, 1871.

Belt, A.—Uncommon Varieties of Arion and Limax—Zool., Oct. 1885, p. 389.

Blair, T.—A short Notice of the Habits of Testacéllus scùtulum. — Loudon's Mag. Nat. Hist., Jan. 1833, pp. 43—47.

Bree, W. T.—Spinning Slugs.—Loudon's Mag. Nat. Hist., Mch. 1829, ii., p. 69.

Brevière, L.—Tableau d. Limaciens d. Envir. de St. Saulge, 1881.

Clarke, Rev. B. J.—On the Species of the Genus Limax occurring in Ireland.— Ann. and Mag. Nat. Hist., Nov. 1843, pp. 332—4.

Cockerell, T. D. A.—Varieties of Arion ater.—Science Goss., June 1885, p. 140.

A New Variety of Limax maximus.—Nat. World, Sept. 1885, p. 178.

Chamæleonic Arions.—Science Goss., June 1886, p. 140.

Limax arborum and the Influence of Altitude on Colour.—Zoologist, Aug. 1886, pp. 418—420.

Slug Variation.—Science Goss., Jan. 1887, p. 16.

On Agriolimax montanus in Colorado.—Journ. of Conch., Oct. 1888, p. 358.

Notes on Slugs, chiefly in the Collection at the British Museum.—Ann. and Mag. Nat. Hist., 1890, pp. 278 and 380 ; also 1891, pp. 97 and 328.

Synopsis of the principal Varieties of Agriolimax agrestis.—Naut , Oct. 1891.

On the Geographical Distribution of Slugs.—Proc. Zool. Soc., 1891, p. 214.

Arion circumscriptus Johnst. = bourguignati Mabille.—Brit. Nat., 1891, p. 20.

Notes on A. hortensis, A. circumscriptus, and their Allies.—Conch. i., p. 33.

The Genera Limax, Arion, and Helix.—Conch., June 1892, ii., p. 28.

The British Arionidæ.—Conch., Dec. 1892, p. 84.

A Revised List of the Species of British Slugs.—J. of Conch., 1892, p. 66.

The Endemic Features of the British Slug Fauna.—Sci. Goss., 1892, p. 255.

A Check List of the Slugs.—Conch., Sept. 1893, pp. 168—176 ; and Dec. 1893, pp. 187—228.

Collinge, W. E.—Notes on the Variation of the Genus Arion.—Ann. and Mag. Nat. Hist., 1892, pp. 307—8.

Description of a New Variety of Arion hortensis Fér., and A. circumscriptus Johnst.—Conch., 1892, ii., p. 26.

Limax maximus and its variety cinereo-niger Wolf.—Ann. and Mag. N.H., 1892, pp. 425—6.

List of British Land and Freshwater Mollusca.—Conch., 1892, p. 34.

A Catalogue of the Slugs of the British Isles.—Brit. Nat., 1892.

A Review of the Arionidæ of the British Isles.—Conch., Dec. 1892, p. 78.

On the Structure and Affinities of some European Slugs.—Conch., March 1893, p. 113.

Some Notes on Irish Slugs.—Irish Nat., July 1893, p. 148.

Collinge, W. E. (*continued*).—
Description of the Anatomy, etc., of a New Species and Variety of Arion.—Ann. and Mag. Nat. Hist., Oct. 1893, p. 252, pl. ix.
On the occurrence of Arion lusitanicus Mabille in the British Isles, and Description of Four New Varieties.—Ann. and Mag. N.H., 1893, pp. 414—415.
The Anatomical Characters of Arion flagellus.—Irish Nat., 1893, p. 316.
On the variety cinereo-niger Wolf of Limax maximus L.—Ann. and Mag. Nat. Hist., 1893, pp. 286—7.
Note on a Species of Limax from Ireland.—Journ. of Mal., 1894, pp. 51—52.
The Anatomy and Description of a New Species of Arion.—Ann. and Mag. of Nat. Hist., 1894, p. 66, pl. v.
Description of a New Species of Slug of the Genus Limax from Ireland.—Journ. of Mal., 1895, p. 4 and fig.
Some Observations on certain Species of Arion.—Journ. of Mal., May 1897.
On the occurrence in Ireland of Arion empiricorum var. bocagei Simr.—Journ. of Mal., vii., p. 33.

Conacher, John, junr.—Limax tenellus and Anodonta cygnea var. incrassata in Scotland.—Naturalist, July 1878, p. 177.

Creighton, C.—Glycogen of Snails and Slugs, 1899.

Dall, W. H.—Thread Spinning by Arion hortensis.—Science, Dec. 1883, p. 773.

Daniel, J. E.—Thread-spinning by Slugs.—Sci. Goss., Sept. 1875, p. 206.
A Catalogue of the Mollusca found in the Neighbourhood of Heidelberg, Grand Duchy of Baden.—Quart. Journ. of Conch., Aug. 1875, pp. 111—118.

Denson, John, jr.—Some Account of the Limax sowerbyi of Férussac.—Loudon's Mag., v., p. 693—697, Nov. 1832; and vi., pp. 46, 47, Jan. 1833.
A short Notice of the Habits of Testacellus scutulum.—Loudon's Mag., vi., pp. 44—46, Jan. 1833.
On the Habits of Testacella scutulum.—Loudon's Mag. Nat. Hist., May 1834, pp. 226—230.

Esmark, B.—On the Land and Freshwater Mollusca of Norway.—J. of Conch., v., pp. 90—131.

Evans, W.—Note on Limax tenellus Müll.—Proc. R.P.S.E., 1904, pp. 22—24.

Gain, W. A.—Some remarks on the Colour Changes in Arion intermedius Norm.—Conch., Sept. 1892, p. 55.
Notes on the Food of some of the British Mollusks.—Journ. of Conch., Apr. 1891, pp. pp. 349—361.

Grateloup, J.—Dist. géogr. de la fam. des Limaciens, 1855.

Gray, J. E.—Teeth of Testacellus and Glandina.—Ann. and Mag. Nat. Hist., Dec. 1853, p. 478.
On the Teeth of the Black and Wood Shell Slugs.—Ann. and Mag. Nat. Hist., June 1858, p. 464.
Habits of Snails or Black Slugs (A. ater).—Ann. & Mag. Nat. Hist., Dec. 1838.

Hanitsch, R.—Contributions to the Anatomy and Histology of Limax agrestis.—Proc. Biol. Soc., Liverpool, May 1888, ii., pp. 152—170, and pl. x.—xii.

Harte, William—Molluscan Threads.—Sci. Goss., May 1874, x., p. 117, 8.
Notes on certain Movements of the Limacidæ.—Proc. Nat. Hist. Soc. Dublin, 1863, iii., pp. 182, 3.

Heynemann, D. F.—Die Nacktschnecken in Deutschland seit 1800 und ein neuer Limax.—Mal. Bl., Mch. 1862, ix., pp. 33—57.
On the French Species of the Genus Geomalacus.—Ann. and Mag. Nat. Hist., Apl. 1873, pp. 271—275.
Einige Mittheilhungen über Schneckenzungen mit besonderer Beachtung der Gattung Limax.—Mal. Bl., Oct. 1863, pp. 200—216, and pl. ii. and iii.
Zur Kenntniss von Geomalacus.—Nach. Mal. Ges., Sept. 1869, pp. 165—8.
Geomalacus maculosus Allman.—Nach. Mal. Ges., July 1871, p. 126.
Die Nackten-Landpulmonaten des Erdbodens.—Jahrb. Deutsch. Mal. Ges., pp. 236—330, 1885.
Ueber Geomalacus.—Mal. Bl., xxi., pp. 25—36 and pl.
Die Geographische Verbreitung der Nacktschnecken.—1905.

Hoy, Thomas.—Account of a Spinning Limax or Slug.—Linn. Trans., 1791, i., pp. 183—5.

Johnston, G.—A few Remarks on the Class Mollusca in Dr. Fleming's Work on British Animals, with Descriptions of some New Species.—Edinb. New Phil. Journ., vol. v., p. 76, June 1828.
A List of the Pulmoniferous Mollusca of Berwickshire and North Durham.—Berwicks. Club Proc., vol. i., p. 154, 1838.

Jenyns, Rev. L.—On a peculiar Species of Mite, parasitical on Slugs.—Loudon's Mag. Nat. Hist., Nov. 1831, iv., pp. 538—541, and f. 109.

Kaleniczenko, J.—Description des Limaces qui se trouvant dans l'Ukraine.—Bull. Soc. Imp. Nat., 1851, xxiv., pp. 109—126, and pl. iv.

Kew, H. Wallis.—On the Mucus-Threads of Land Slugs.—Journ. of Conch., July 1901, p. 92.

Latham, J.—Observations on the Spinning Limax.—Linn. Trans., 1798, pp. 85-89.

Leach, W. E.—A Synopsis of the Mollusca of Great Britain, 1852.

Lehmann, R.—Die Nacktschnecken aus der Umgebung Stettins und in Pommern.—Mal. Bl., 1862, ix., pp. 156—193, and pls. 2—5.
Die Lebenden Schnecken und Muscheln der umgegend Stettins und in Pommern.—1873.

Lessona & Pollonera.—Monografia dei Limacidi Italiani, 1882, pp. 82 and 3 pls.

Lessona, M.—Molluschi viventi del Piemonte, 1880.
Sugli Arion del Piemonte, 1881, pp. 14 and pl.

Lukis, F. C.—A Notification of the Occurrence in the Island of Guernsey of a Species of Testacellus and of some of its Characteristics and Habits as observed there.—Loudon's Mag., May 1834, vii., pp. 224—30.

M.—Spinning Slugs.—Loudon's Mag. Nat. Hist., July 1829, p. 303.

Mabille, M. J.—Des Limaciens Européens.—Rev. et M. Zool., 1868, pp. 129-146.

Malm, A. W.—Limacina Skandinaviæ, 1868.

Mark, E. L.—On the Early Stages in the Embryology of Limax campestris.—Zool. Anz., Sept. 22, 1879, pp. 493—496.

Martens, E. von.—Zur Kentniss der fadenspinnenden Schnecken.—Zool. Anz., Nov. 1878, pp. 249—251.

Moquin-Tandon, A.—Observations sur la langue de la Testacelle (Testacellus haliotideus F.-B.).—Journ. de Conch., July 1851, pp. 125—128.

Musson, C. T.—On the Naturalized Forms of Land and Freshwater Mollusca in Australia.—Proc. Linn. Soc. N.S.W., 1891, p. 883.

Newton, R. Bullen.—The Geological Distribution of Extinct British Non-Marine Mollusca.—Journ. of Conch., 1891, p. 58.

Nilsson, Svenone.—Historia Molluscorum Sveciæ terrestrium et ffuviatilium breviter delineata.—1822, pp. 124.

Nunneley, Thos.—A description of the Internal Structure of various Limaces found in the neighbourhood of Leeds.—Trans. Leeds Phil. and Lit. Soc., 1837, i., pp. 41—79, and pls. 1—7.

Pilsbry, H. A.—Phylogeny of the Genera of Arionidæ.—Proc. Mal. Soc., July 1898, pp. 94—104.

Pini, N.—Molluschi terrestri e d'Acqua dolce viventi nel Territorio di Esino.—1876, pp. 144, and 2 pls.

Pollonera, Carlo.—Nuove contribuzioni allo Studio degli Arion europei.—R. Accad. d. Sci. Torino, 1889, pp. 20 and pl.
A proposito degli Arion del Portogallo.—Boll. Mus. Zool. ed Anat. Comp., May 1890, pp. 1—7.
Recensement des Arionidæ de la Région Paléarctique, 1890, pp. 42.

Roebuck, W. Denison.—The British Slug List.—J. of Conch., Apr. 1883, p. 38.
Limax cinereo-niger, an Addition to British List.—Zool., July 1883, p. 304.
Carnarvonshire Notes, July 1883.—Journ. of Conch., Oct. 1883, p. 113.
Testacella—A Query for West of England Conchologists.—Science Gossip, Nov. 1883, p. 256.
Varieties of British Slugs.—Science Gossip, Nov. 1883, p. 257.
Slug new to Yorkshire.—Naturalist, Nov. 1883, p. 68.
Slugs in County Waterford.—Zool., Dec. 1883, pp. 507, 508.

Roebuck, W. Denison (*continued*).—
New Variety of Arion ater.—Journ. of Conch., Jan. 1884, p. 146.
Slugs in County Durham.—Naturalist, Aug. 1884, p. 20.
Gloucestershire Slugs.—Science Gossip, April 1884, pp. 78, 79.
Limax maximus var. maculata Picard in Britain.—J. of C., Jan. 1884, p. 150.
Limax maximus var. johnstoni Moq. in E. Gloucestershire.—Id., iv., p. 158.
Limax agrestis var. reticulata Müll. in Britain.—Id., iv., p. 134.
Arion ater var. bicolor in W. Gloucestershire.—Id., iv., July 1884, p. 217.
Limax maximus var. férussaci in County Antrim.—Id., iv., July 1884, p. 222.
New Variety of Limax flavus [grisea].—Id., iv., July 1884, p. 223.
Variations in Lehmannia arborum, the Tree Slug.—Journ. of Conch., Jan. 1885, pp. 276—280.
A New Variety of the Cellar Slug, Limax flavus var. suffusa.—Journ. of Conch., July 1885, p. 352.
New Varieties of Limax arborum and Arion ater.—Journ. of Conch., Oct. 1885, pp. 375, 376.
Arion ater var. nov. cinerea at Nottingham.—Naturalist, Sept. 1888, p. 284.
Slugs, etc., in South Lincolnshire.—Naturalist, May 1889, p. 130.
Orange coloured Arion ater at Durham.—Naturalist, July 1889, p. 212.
The specific rank of Limax cinereo-niger Wolf.—Ann. and Mag. Nat. Hist., 1893, pp. 225—226.

Scharff, R. F.—Arion minimus Simroth a British Slug.—Journ. of Conch., iv., p. 267, 1890.
The Slugs of Ireland.—Sci. Trans. Roy. Soc. Dublin, 1891, pp. 46 and 2 pls.
On the Affinities of the Genera Limax, Arion and Helix.—Conch., 1892, p. 83.
Note on the Geographical Distribution of Geomalacus maculosus Allm. in Ireland.—Proc. Mal. Soc. London, 1893, p. 17.
A new Irish Species of Arion.—Irish Nat., 1893, p. 302.
A supposed New Species of Limax from Ireland.—Irish Nat., 1894, p. 261.

Scott, T.—Conchological Notes.—Journ. of Conch., Oct. 1887, p. 228.

Simroth, H.—Versuch einer Naturgeschichte der Deutschen Nacktschnecken und ihrer europäishen Verwandten.—1885, pp. 163 and 5 pls.
Beiträge zur Kenntniss der Nacktschnecken.—1889, pp. 92 and 4 pls.
Über die nackten Limaciden und Testacelliden des Kaukasus.—Sitz.-Ber. Nat. Ges. Leipzig, 1891, pp. 40—49.
Über Kaukasische Limaciden und Testacelliden.—Verh. Deutsch. Zool. Ges., 1891, p. 57.
On some Testacellæ.—Journ. of Conch., Oct. 1891, p. 413.

Sterki, V.—Growth Changes in the Radula of Land Mollusks.—Proc. Acad. Nat. Science Philad., 1893, pp. 388—400 and 2 pls.

Tapping, T.—Observations on the Genus Testacellus and Description of a New Species, Testacellus medii-templi.—Zool., 1856, pp. 5099—5107.

Tate, R.—On some Australian Slugs, chiefly Tasmanian.—Proc. Roy. Soc. Tas., 1880, pp. 15—17.

Taylor, J. M. B.—Testacella scutulum Sow. in Renfrewshire.—Journ. of Conch., July 1889, p. 114.

Tomlin, J. R. B.—British Slugs.—Sci. Goss., Dec. 1886, p. 279.

Tye, G. Sherriff.—On a case of Protective Resemblance among Slugs.—Journ. of Conch., June 1894, pp. 21, 22.

Webb, W. M.—Slugs.—Sci. Goss., June 1887, p. 124.

Westerlund, C. A.—Fauna d. in d. Palæarctischen region lebenden Binnenconchylien, 1886.

Williams, J. W.—Limax maximus v. marmorata.—Nat. World, Dec. 1885, p. 235.
On the Variation and Continental Distribution of British Slugs.—Sci. Goss., 1886, pp. 54—56, 146—148, 99, 201—203, and 1887, p. 10.
Slugs and their Varieties.—Young Nat., Oct. 1887, pp. 188—191.
Our British Slugs.—Sci. Goss., 1887, pp. 10 and 44.
Slug Gossip.—Sci. Goss., 1887, pp. 222, 223; 243, 244; 265—267.

Wotton, F. W.—The Life-History of Arion ater and its Powers of Self-Fertilization.—Journ. of Conch., vii., p. 158.

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